ANESTHESIA SUPPLEMENT — FOLLOWING PAGE 32

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THE TREATMENT OF CANCER BY PHYSICAL METHODS WITH AND WITHOUT SURGERY.

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NEW YORK.
(From the Physical Laboratory of the Huntington Cancer Commission, General Memorial Hospital, N. Y. City.)

The electrical methods employed in the following series of cases were deep Röntgentherapy, fulguration (De Keating-Hart) desiccation (Clark), and diathermy (Nagelschmidt). These therapeutic agencies were combined with surgery, radium, toxins, and vaccines, when such adjuvants were indicated. The results obtained were due, not so much to any originality of method, as to the correlation of several very excellent methods, already described, but little understood, and seldom used by the profession at large. Inasmuch as we have been treating these cases only during the past ten years, sufficient time has not elapsed to warrant any final statement concerning the successful cases, other than that they are now symptomatically well.

For our purposes malignant lesions may be divided into three classes, viz., those in the first, second, and third degrees of malignancy.

1. THE FIRST DEGREE OF MALIGNANCY.

(a) Cases having superficial skin lesions tending to extend out from the skin rather than into the underlying structures. (b) Those which do not extend more than one cm. beneath the skin. These are characterized by slow growth, long duration, and a tendency not to metastasize early.

Histological characteristics. Growths of this class of malignancy in our series showed the histological formation of papillary epithelioma, basal-celled epithelioma, mycosis fungoides, and pre-epithelial keratoses.

Prognosis. The prognosis of such cases treated by the above methods is 100 per cent. good. They can be cured by physical methods, without surgery, pain, hemorrhage, opening up the lymph channels, danger of infection, implantation of malignant cells, or hospital confinement, and with the best cosmetic results.

Thereapeutic methods. These cases should not be treated by cutting operations. The physical methods indicated in the order of their preference are: (a) Massive doses of Röntgen rays; (b) desiccation; (c) radium; (d) destructive caustics, provided the more expensive equipments are not available.

If improperly treated or neglected, these cases may develop into the second or third degree of malignancy.

2. THE SECOND DEGREE OF MALIGNANCY.

(a) Those operable tumors, characterized by rapid growth, and tend to extend rapidly into the deeper structures, and to metastasize early. Carcinomata of the breast and operable sarcomata are very good examples of this class.

Histological characteristics. Growths of this class of malignancy in our series of cases showed the histological formation of basal-celled epithelioma, and alveolar and medullary carcinomata of the breast.

Therapeutic methods. (a) Preoperative massive doses of Röntgen rays; (b) thorough radical operation; (c) fulguration at the time of operation; (d) post-operative deep Röntgentherapy or radiotherapy. By the use of these adjuvants to surgical treatment, the percentage of recovery in this class of patients has been materially increased.

3. THE THIRD DEGREE OF MALIGNANCY.

Inoperable superficial and deep malignant conditions.

Prognosis. These patients, as a rule, cannot be cured by any method of treatment, and are undesirable subjects, as the ultimate prognosis is 100 per cent. bad. Despite this fact, in our series of 116 cases of the third degree of malignancy, 6 cases (5.8 per cent.) to date remain symptomatically well; 24 (20 per cent.) showed marked primary improvement after massive Röntgen ray treatment was instituted. This in itself is sufficient to demonstrate even to the most conservative that deep Röntgenotherapy has an action on malignancy which might well be called inhibitory. This inhibitory action, shown in these hopelessly advanced cases, is the same action which becomes annihilatory in less advanced cases.

Therapeutic methods. The symptoms can usually be improved by electrical methods and radium,

The results obtained in all three classes of cases have been noticeably better since the installation of the Coolidge tube. We have operated the Coolidge tube with a parallel spark gap of 10 inches, with miliamperage of 5, getting 15 X through filters of 3 m.m. of aluminum and a filter sensitized paper in 3 minutes.

The foregoing division of all cancers into three classes of malignancy, is valuable for determining both the prognosis and the treatment. Cases of the first degree of malignancy *can* be cured; cases of the second degree of malignancy *may* be cured; cases of the third degree of malignancy, as a rule, cannot be cured. The majority of cures of malignancy referred for treatment by physical methods are cases of third degree of malignancy, and this accounts for the poor results frequently obtained. Much time may be lost in cases of the second and

Before treatment. After treatment.

Fig. 1.—First degree of malignancy.

Superficial epithelioma of the forehead. Complete recovery under massive Röntgen therapy.

third degree of malignancy, and the patient's life endangered, if one is deceived by the well-known superficial healing properties of radium as well as of the *x*-rays. The fact that lesions of the second degree of malignancy appear at first to improve, under treatment indicated only for cases of the first degree, gives a false sense of security, and results only in therapeutic procrastination, and the development of second degree cases into a malignancy of the third degree while under a form of treatment suited only to cases of first degree malignancy.

Of the first degree of malignancy, we have thirteen cases, nine of which have been symptomatically cured under massive doses of *x*-ray, four of which are symptomatically cured with radium, and one, symptomatically cured under the combined treatment of both massive doses of *x*-ray and radium.

Of the second degree of malignancy, we have a total of ten cases; four of epithelioma of the skin and six of carcinoma of the breast, all treated by a combination of massive doses of *x*-ray, radical operation, and fulguration, followed by massive doses of *x*-ray or radium. Three of these patients are still under treatment; five have been discharged symptomatically cured; and two have discontinued

Fig. 2.—First degree of malignancy.

Case of mycosis fungoides, in which the lesion on the right temporal region was treated by surgical removal and skin grafting. The lesion on the left temporal region was treated by massive Röntgen therapy. The lesions on the cheeks and neck were treated by desiccation.

treatment. All of those patients who have continued the treatment are symptomatically well, although sufficient time has not elapsed to warrant the statement that they have been completely cured.

In the third degree of malignancy we had 116

Fig. 2a.—Mycosis fungoides after treatment.

The best cosmetic results were obtained by radium, desiccation, and massive Röntgen therapy. In the lesions treated by dessiccation there has since been recurrence. Other mycosis lesions have appeared in other parts of the body. All these lesions are now being treated by radium or *x*-rays.

cases, divided into groups according to the accompanying table:

Diagnosis.	No. of Cases.	Symp'y Well.	Improved.	Unimproved.	Dead.
Epithelioma	21	0	4	10	8
Carcinoma of breast	22	1	3	9	6
Lymphosarcoma	11	1	4	3	3
Round celled sarcoma	2	0	0	2	0
Spindle celled sarcoma	9	1	3	3	1
Chondrosarcoma	1	1	1	0	0
Melanosarcoma	2	0	0	1	0
Miscellaneous sarcomata	7	0	3	3	0

Hodgkin's disease.....	5	2	3	0	2
Chronic lymphatic leukemia...	1	0	1	0	0
Carcinoma of uterus.....	10	0	2	2	2
Miscellaneous tumors.....	25	0	0	5	15
	116	6	24	38	37
Percentage		5.8	20.	32.22	32.

On account of the extravagant exploitations of radium by the profession, as well as by laymen, a statement as to the relative value of this therapeutic agent as compared with other physical methods may be valuable.

Radium has been fortunate in many respects in its exploitation. In the first place, it is so rare and expensive that it has been placed only in the hands

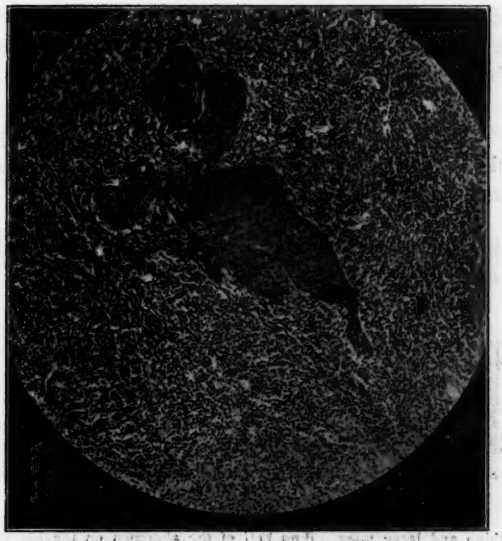

Fig. 2b.—Photomicrograph, case of mycosis fungoides.

of well-known physicians, surgeons, or scientists, who have felt in duty bound to test it extensively and report upon its properties. Their results are not nullified by a great multitude of mediocre or unreliable results promulgated by inexperienced observers who happened to have a few hundred dollars that they were willing to invest in the new agent, as was the case when *x*-ray machines were put on the market. Consequently, radium has been taken much more seriously than its predecessor in the radio-active field, the *x*-rays. Electricity of any kind in medicine is not taken very seriously by the profession as a rule, largely because of the unscientific character of the majority of men who have exploited it. It is a singular fact that the radium workers, who are more scientific as a whole, do not seem to be familiar with the therapeutic effects obtained by means of *x*-rays in efficient workers' hands. Several of the best known radium workers have pointed with pride to their results in treating epitheliomata, the various leukemias, Hodgkins' diseases and exophthalmic goiters, for instance, and have shown surprise when informed that *x*-ray workers reported the same results years ago, and that successful treatment of these conditions is a routine occurrence in the practice of good Röntgentherapists. In personal conversation with

Fig. 3.—Second degree of malignancy.

Case of epithelioma of the nose in a patient suffering from extensive lupus (non-ulcerative). The tumor developed on the nose after a local treatment of the lupus with carbon dioxide snow. The epithelioma was removed surgically, the base fulgurated (De Keating-Hart), followed by massive Röntgentherapy. The lupus was treated by massive Röntgentherapy, the resistant edges being controlled by desiccation (Clark). An artificial nose has since been fitted and the patient makes a very presentable appearance.

some of the most noted radium workers in this country, they have looked skeptical, even when they refrained from expressing skepticism, when assured that *x*-rays properly administered will control all the symptoms complained of in exophthal-

Fig. 3a.—Photomicrograph, case of epithelioma of nose.

mic goiter except exophthalmos, and that the blood counts and lymphatic enlargements in leukemias and pseudo-leukemias can all be controlled at least temporarily. These results are established facts attested by numerous authentic references in medical

literature. Whether these results obtained by radium will be more permanent than those obtained by *x*-rays cannot be stated at the present time, as the radium cases are too recent to warrant any conclusion. There really should be little or no rivalry between these two agents at the present time, as they are similar agents that can be used as tremendous assistants in the surgical relief of cancer.

Fig. 4.—Third degree of malignancy.

Case of primary lymphosarcoma of the tonsil, involving the cervical glands. Treated at first by toxins with slight, if any, improvement. Within forty-eight hours after the first massive dose of deep Röntgentherapy, the size of the tumor had diminished fifty per cent. Under the combined treatment of toxins and *x*-rays, the patient steadily improved to the condition shown in the "after treatment" illustration. He subsequently relapsed and failed to respond to any treatment. This is commonly the history in cases of lymphosarcomata, Hodgkin's disease, leukemia, and allied conditions, i. e., marked primary improvement progressing often to apparent recovery, but, as a rule, these patients die sooner or later of the condition despite all changes in the technic, including raying of the long bones. In this class of cases every effort should be put forward to make permanent the initial good results.

In comparing the relative value of the various physical methods, six points may well be considered:

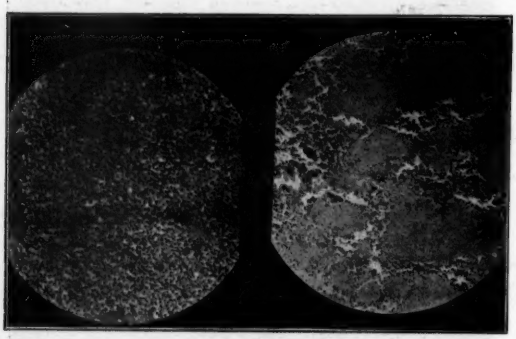

Fig. 4a.—Photomicropraphs. Case of lymphosarcoma of the tonsil and metastasis.

1.—COST.

Radium is far more expensive than any of the other methods. Massive *x*-rays, electric desiccation and ultra-violet rays come next in expense. Surgery and caustics are the cheapest.

2.—EASE OF APPLICATION.

As to ease of application, much depends upon the training of the individual who administers the treatment. Each therapeutist will naturally do the best work with the greatest ease by employing that agent with which he is most familiar. Other things being equal, radium and caustics are easier to apply than the other agents in question.

3.—TIME CONSUMED IN TREATMENT.

Radium applications are much longer in duration than any of the other methods. They require hours while the other treatments require minutes.

4.—PAIN.

Radium, *x*-ray, and ultra-violet light treatments, cause no pain. Electric desiccation and carbon dioxide snow cause slight pain. Surgery and cauterization are very painful and require a local anesthetic. Chemical caustics are the most painful.

5.—COSMETIC EFFECTS.

Cosmetic effects are best after radium, *x*-rays, ultra-violet light, desiccation, and carbon dioxide snow, and poorest after surgery or cautery.

Fig. 5.—Third degree of malignancy.

Case of myxolymphosarcoma. Extensive tumor of the right thigh and large mass, filling half of the abdomen on the left side. It was impossible to remove all the tumor tissue from the thigh at operation, and no surgical removal of the abdominal mass was attempted. Post-operative deep Röntgentherapy caused the complete disappearance of all evidence of both the tumor masses. In this class of patients a regular system of prophylactic treatments should be instituted to guard against recurrence. (Since this was written, the patient has returned with a recurrence in the thigh. As yet there is no evidence of a return of the abdominal tumor.)

6.—DANGERS.

With a proper technic there are no dangers in any of these methods. Poor technic is a de facto contra-indication for the use of any agent, for it will need the combined energies of the advocates of both forms of radio-activity to persuade the surgeons of today to admit that there is any efficacy in either method.

The electric cautery of Percy seems to have made some impression on the surgical mind, but the virtues of desiccation, diathermy and fulguration are hardly known and seldom practiced by surgeons. It is to be hoped that the propaganda of radium, associated with the timely invention of the Coolidge tube, will call to the attention of the medical profession the value of electrical methods. This can hardly result in a large vogue for these methods unless championed by prominent surgeons.

MALIGNANCIES OF THE GASTRO-INTESTINAL TRACT.

The only hope for the relief of internal growths is to diagnose them in their incipiency. By the proper use of the Röntgen rays, a positive or negative diagnosis of carcinoma or ulcer of the gastro-intestinal tract can be made in the earliest stages of the involvement. Furthermore, its size, shape, and position can be determined, painlessly and without shock or danger. This accurate information affords an opportunity for the early and successful removal, by surgical operation, of the cancer or ulcer bearing area, moreover reducing the time required for surgical examination and operation, and consequently the amount of shock entailed, so that the precentage of recoveries after surgical removal is increased.

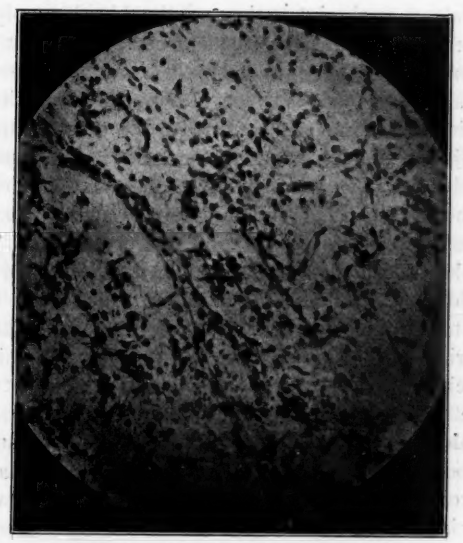

Fig. 5a.—Photomicrograph of case of myxo-lympho-sarcoma.

The problem of handling malignancy to-day resolves itself, therefore, into:

1. The proper treatment of external cases of the first degree of malignancy, lest they develop into cases of the second and third degree of malignancy.

2. Increasing the palliative effects possible for external tumors of the second and third degrees of malignancy, so that they may be regarded as actually remedial.

3. The diagnosis and early surgical removal of ulcer-bearing areas and malignant conditions of the gastro-intestinal tract in their incipiency.

CONCLUSIONS.

1. Incipient surface cancers can be cured: (a) if *superficial*, by physical methods; (b) if *deep*, by physical methods and surgery.

2. The physical methods employed include massive *x*-ray doses, desiccation (Clark), fulguration (De Keating-Hart), diathermy (Nagelschmidt), and radium.

Beginning cancer of the gastro-intestinal tract can be diagnosed with accuracy by recently improved *x*-ray methods.

4. Advanced cancer, either internal or external, cannot be cured by any known method.

5. The successes herein reported are due not to the discovery of any one new factor, but rather to the combined application of the best and most effectual electro-physical technic, both in early diagnosis and prompt treatment, the results of which, if permanent, are invaluable.

6. The methods herein advocated are very costly.

I am grateful to the members of the Commission and the staff of the General Memorial Hospital for their co-operation, and particularly to my assistants in the electro-physical department for their faithful and painstaking work.

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RETENTION OF URINE IN INFANTS.

Retention in the newly born babe may be due to one of several causes for which, when a doubt exists, the infant should be examined: (1) Imperforate meatus urinarius, either glandular or preputial; (2) marked phimosis simulating imperforate preputial meatus; (3) cyst of the sinus pocularis; (4) impacted mucus or calculus within the urethral canal; and (5) atresia.—T. C. STELLWAGEN, JR., in *The Pennsylvania Medical Journal.*

THE CHOICE OF INCISIONS IN HAND INFECTIONS.*

ALBRO L. PARSONS, M.D.,
LOUISVILLE, KY.

In this paper only infections of the palmar aspect of the hand will be discussed. Infective lesions involving the dorsal surface are infrequently encountered.

I have examined the literature of hand infections, and find only three contributions of importance published during the last ten years. First, and of greatest value, is the classical monograph of Kanavel, of Chicago, "Infections of the Hand" (edition, 1914), to which I am indebted for many of the data here presented. Second, is an article by White, of England, which appeared in the *London Lancet* a few months after publication of the first edition of Kanavel's monograph. White's article is extensively quoted by DaCosta in his recent book on surgery. The third contribution is by a Frenchman, Picque.

The subject of hand infections is so extensive that my remarks will be principally confined to one phase, *i.e.*, the sites of the several incisions which will best drain the infected hand with the least damage to the other tissues. Furthermore, I shall discuss only acute and subacute infections that involve the tendon sheaths and fascial spaces of the palmar surface.

To briefly review the anatomy of the palmar tendon sheaths: Those of the index, middle and ring fingers extend from the base of the terminal phalanx to "Kanavel's line," *i.e.*, a line drawn between the radial end of the proximal phalangeal crease and the ulnar end of the distal palmar crease, roughly a thumb's breadth above the web. These sheaths pass near the proximal interphalangeal joint, and this fact may account for its more frequent involvement than the metacarpophalangeal joint from which the sheaths are well separated. The sheath of the flexor longus pollicis pursues relatively the same course, excepting that nineteen times out of twenty it does not terminate at the root of the thumb, but continues upward into the radial bursa, which in turn extends to a point one inch above the annular ligament between the pronator quadratus and the flexor tendons. The little finger sheath imitates its fellows until it reaches the hand. From this point in about half the cases it extends into the ulnar bursa, which also passes above the annular ligament upon the pronator quadratus, "hugging" the ulnar side of the superficial and deep tendons of the wrist with prolongations extending between them. In approximately half the instances a communication exists between the radial and ulnar bursae.

Four fascial spaces are embraced within the scope of this paper: The first is what may be called the terminal phalangeal space—the site of felons. This space is composed of the fatty cushion at the finger end, and is divided into numerous compartments by fascial bands which extend roughly from bone to skin. Alongside of this space are the blood-vessels that nourish the shaft of the terminal phalanx, and obstruction of the blood supply by pressure explains the frequent necrosis of that portion of the bone in felons. Next are the web spaces, *i.e.*, those between the fingers. Infection in this loose tissue may extend to the dorsum, to the adjacent fingers, or along the lumbrical muscles to either of the two spaces to be next described. These, the thenar and mid-palmar spaces, may be best described together. They occupy the palm below the tendons and lie upon the interossei and adductor muscles. The third metacarpal bone indicates the point of their separation, excepting at the wrist, where at times the two spaces communicate. Below, these spaces are continuous with what may be called the lumbrical canals. Above, the mid-palmar space terminates near the annular ligament, upon the pronator quadratus. The deep palmar arch is dorsal to these spaces, whereas the superficial arch is palmar to them. Infection may occur in all of these spaces and tendon sheaths, or in any one of them singly. More often, however, the patient is seen only after the infection has invaded other sheaths or spaces.

In order to properly locate the necessary incisions for drainage, it is important to understand just what combinations are likely to be encountered. Terminal phalangeal infections tend to become localized, unless neglected, when the infection may extend either by the fascial spaces to the web, or upward along the tendon sheath, both of which will be specifically mentioned later. Infections of the sheaths of the index, middle and ring fingers may rupture through the skin. The proximal interphalangeal joint is frequently involved, with subsequent necrosis of the middle phalanx. Most often, however, rupture occurs at the proximal end of the sheath, the pus gravitating into the finger web and thence by way of the lumbrical canal to the thenar space if the index finger be involved, and to the mid-palmar space where the middle and ring fingers are implicated. Rarely does middle finger infection invade the thenar space. Little finger infec-

*Read before the Society of Physicians and Surgeons of Louisville, November, 1914.

tions behave in like manner, where the sheath is not connected with the ulnar bursa, otherwise the infection rapidly extends to the forearm under the profundus. Thumb sheath infections invade the forearm through the radial bursa. Pus in the thenar space may invade the mid-palmar space, and *vice versa.* In either event the webs are prone to involvement by way of the lumbrical canals. Pus in the mid-palmar space oftentimes invades the forearm. Web infections may rupture anywhere upon the dorsal or the palmar surface. Both the thenar and mid-palmar spaces are frequently infected. To illustrate the structures which may be infected in regular sequence, I may mention that inflammation of the little finger sheath may extend to the ulnar bursa, to the mid-palmar space, to the radial bursa, to the thumb sheath, and the thenar spaces, each in turn becoming involved. Distally, the finger webs may be infected with possible rupture upon the dorsum. Proximally, the infection may pass upward along the forearm, under the profundus and over the pronator quadratus, and still further extension in the connective tissue of the forearm around the vessels and nerves probably explains the paralyses and trophic changes which supervene in certain cases.

The foregoing comprise the more frequent structures invaded. In addition there may occur osteomyelitis of any of the bones, invasion of the wrist joint, rupture of the mid-palmar space through the dorsum, and a host of other complications.

In operating upon a felon, Kanavel advises a lateral incision, supplemented at times by a counter opening. Thus he claims to more thoroughly divide the fascial bands which traverse the terminal phalangeal space, and also avoids placing the scar on the palmar surface. Babcock (*Journal of the A. M. A.,* June 14, 1913), from personal experience with this incision, states that the sense of touch is impaired, and recommends the time-honored median incision. Dorrance (*Journal of the A. M. A.,* May 10, 1913) "goes Kanavel one better" and joins the distal ends of two lateral incisions around the end of the finger. I have never used this latter incision. Certainly the old median incision left something to be desired, in that it oftentimes had a tendency to prematurely close. In my experience the Kanavel incision has given entire satisfaction, especially when two openings are made, and I have had no complaint of impairment in tactile sense.

Infections of the sheaths of the first, second and third fingers should be attacked from the side. The incisions are made upon the lateral palmar aspect of the two proximal phalanges, and if the infection is severe these incisions are joined over the proximal interphalangeal joint. The sheath should be freely opened by extending the incision the full length of the infected area. This holds true even over the joint, but in such cases the finger must be dressed in extension to prevent tendon prolapse. White warns against incision over the joint for fear of tendon sloughing. This has not been my experience, if the finger is properly dressed.

Infections of the little finger sheath are treated as described in the foregoing paragraph. One must carefully ascertain whether infection has extended to the ulnar bursa, and if not that structure must not be exposed. It is advisable to proceed from the known infected area to the unknown, for, as Kanavel suggests, the hitherto uninfected sheath even if opened first would probably become contaminated from the lymphatics. I believe White's method of aspirating the sheath before opening, so lauded by DaCosta, is only of theoretical value. If the ulnar bursa is involved, it should be incised through the palm on a director to the ulnar side of the sheath. If the infection has invaded the forearm, the incision may be carried around the uncinate hook and the annular ligament may be sacrificed if necessary. Kanavel advises this in some instances, and states if the wrist is dressed in extension no harm results. Probably a better procedure would be to terminate the incision at the distal border of the annular ligament, and drain the space under the profundus tendon at the wrist into which sheath the ulnar bursa is almost certain to rupture. This is accomplished by incising the wrist on the lateral palmar aspect of the ulnar above the joint. Forceps are introduced so that all structures save the bones and the pronator quadratus are palmar to them, and a counter opening is then made upon the radial side. If the infection has extended further upward, invading the forearm around the ulnar vessels, it may be attacked by an incision between the ulna and the flexor carpii ulnaris.

Thumb sheath infections must be opened along the proximal phalanx and through the thenar muscles to a point one thumb's breadth distal to the lower border of the annular ligament. The reason for terminating the incision here is to avoid dividing the motor nerve to the thenar muscles. As the upper end of the radial bursa is always infected and usually ruptures, it must be drained by lateral incisions in the wrist which lead to the "anterior wrist space" already described. Kanavel warns against

mistaking subcutaneous collections of pus upon the anterior aspect of the wrist of lymphatic origin, for the more important pus pockets under the tendons. Drainage of these spaces will not drain the anterior wrist space.

The frequency with which infections of the little finger and thumb sheaths and their respective bursae are associated induced Picque (*Journal de Chirurgie,* October, 1913) to make four incisions, one each along the little finger and thumb, one from the root of the little finger to the radial side of the uncinate hook, and one from the root of the thumb to the base of the thenar eminence. If the infection extends above the annular ligament, he makes two incisions, one on either side of the flexor tendon group which lead downward to the upper ends of the ulnar and radial bursae respectively.

Web infections are treated by incisions upon either the dorsal or palmar aspect of that structure, or by splitting the web. The superficial transverse ligament at the distal border of the hand may be divided without danger, but the deep interosseous ligament must be spared to preserve the integrity of the hand. On the palmar surface the incision may be extended to the Kanavel line, which is distal to the superior arch. As web infection so often extends along the lumbrical canals, the incision should be located over the lumbrical muscle. This has an added importance in regard to the webs of the middle, ring and little fingers, as the mid-palmar space is almost certain to participate in their infection, and the best way to drain this space is by passing forceps through the incision around the dorsum to the lumbrical muscle and thence into the space, as suggested by W. C. Dugan in 1906.

The thenar space rests immediately upon the transversus adductus, and the shortest route thereto is by incising the dorsum of the index-thumb web just radial to the middle of the index metacarpal bone and level with its palmar surface. Forceps are made to pass along the palmar aspect into the thenar space, but never beyond the middle metacarpal bone for fear of infecting the mid-palmar space.

The method of attacking infection of the upper ends of the ulnar and radial bursae and the anterior wrist space recommended by White (*Lancet,* February 24, 1906) is interesting. Severe infection of the ulnar bursa, which is usually found ruptured, he opens by a lateral ulnar incision which drains the anterior wrist space. He makes no counter radial opening as does Kanavel. Less severe ulnar bursa infections (unruptured) he drains by an opening between the flexor tendon and the flexor carpii ulnaris in the same manner as Picque. The radial bursa he finds less often ruptured into the anterior wrist space, and instead of completing the rupture and draining the space as recommended by Kanavel, he drains anteriorly between the radial artery and the flexor carpii radialis. If he fears pressure upon the artery, he excises one inch of the vessel and covers the stumps. He avoids the ulnar side of the flexor carpii radialis for fear of pressure upon the median nerve. Kanavel mentions this point of drainage, but prefers to rely upon the lateral wrist incision.

Picque does not recognize the spaces designated by Kanavel as the thenar and mid-palmar spaces. He deals with palmar abscess as a whole and drains through two incisions which begin near together at the proximal end of the adductor crease and radiate distally, one being directed toward the web between the little and ring fingers, and the other toward the web between the index and middle fingers. Such incisions must sever the superior palmar arch, and furthermore the pus is drained through the tendon group. The first of these incisions opens the mid-palmar space, but how much better is Kanavel's method of drainage—over the involved lumbrical canal, away from the tendons and distal to the arteries. The second Picque incision opens the inner end of the thenar space. Kanavel drains by a shorter route, traversing the tissue of the dorsum—the usual site of overflow when the thenar space ruptures. Furthermore, by the latter method injury to the palmar structures is avoided.

Although the scope of this paper does not include specific methods in the treatment of hand infections, I cannot forego the mention of a few general points, with the correctness of which I had become convinced before reading the monograph of Kanavel so frequently quoted herein.

(1) In operating for hand infections a general anesthetic should be employed. In uncomplicated felons this rule may sometimes be disregarded.

(2) Make the field bloodless by the employment of a suitable tourniquet.

(3 For drainage use gutta percha tissue (not tubes) or gauze saturated with balsam of Peru and oleum recini. Kanavel recommends gauze impregnated with vaseline.

(4) As a rule wet dressings are continued too long.

(5) The operation should be slowly performed, the various structures being identified as encountered, remembering that the procedure is not so simple as the opening of a boil.

PAINLESS CHILDBIRTH IN FRANCE: A NOTE UPON THE USE OF TOCANALGINE.

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In 1847, a few months after the discovery of ether, Deschamp in Paris wrote an article entitled "Ether in a Case of Application of Forceps," and in the same year Dubois wrote on "Application of Ether in Labor." So from the very earliest days France was alive to the need of easing, wherever possible and safe, the pains of childbirth. In 1854 appeared articles on chloroform in labor from the pens of Pajot, of Perrin, and many other Frenchmen. The "Sleep à la Reine" was much in vogue after its discovery by Simpson, of Edinburgh, especially after he had used it when royalty was in labor.

In 1878, Pinard wrote a most elaborate and able monograph entitled "The Comparative Action of Chloroform, Chloral, Opium, and Morphine on Women in Labor," and most of his deductions still hold. He felt that chloral was of little value, and that while morphine was frequently useful its results were not as satisfactory as those of chloroform. Chloral stopped the labor every time; morphine only at times.

In 1885, Doleris, working with Dubois, attempted the local use of cocaine in solution and in salves applied to the genital tract, to make labor less painful, but with little result.

Later Tuffier and Malartic and others tried spinal cocanization in obstetrics. But aside from its dangers the anesthesia lasted only two hours. Shortly after, stovaine was discovered, and that, too, was used intraspinously, but it in turn had to be discarded.

When Kroenig and Gauss first reported their results with scopolamine and morphine, Le Lorier, working on the service of Dessaignes, tried this method with the same difficulties that confronted many others at that time,—difficulties due, I should say, to the fact that the Freiburg recommendations were not followed in detail and also to the instability and unreliability of the drug, as then prepared.

But the great need of something to alleviate the sufferings of childbirth and to encourage a possible increase of the birth rate in this age being ever present in France, Prof. Ribemont Dessaignes of the University of Paris gladly sought the opportunity to try tocanalgine when the virtues of that drug were proclaimed by the chemists Laurent and Paulin.

This drug is obtained by the action of living ferments on the chlorhydrate of morphine. The living ferments resemble those used in beer leavening. Morphine is almost entirely transformed into a substance which crystallizes in a very regular way. So we see that the drug closely resembles the oxydimorphine of Marne; it seems to be a product of hydration and hydrogenation of morphine. But, strangely enough, it possesses not one of the chemical reactions of morphine itself and is only one-fifteenth as toxic.

It was in July, 1914, that Prof. Ribemont Dessaignes reported to the Paris Academy of Medicine his results with tocanalgine. He tried it in 112 cases without a single bad result. The drug acts on the nervous centers of the brain and sympathetic system where it is brought from the point of injection by the circulatory system. The pains disappear in from 3 to 15 minutes after the administration of the drug; rarely it takes 30 minutes. As a rule the patients sleep between pains but are easily aroused by asking them a question. Those who do not sleep are apt to be excited and talkative and, though conscious of uterine contractions, they perceive no sensation of uterine pain. Eighty-four of his 112 patients had complete analgesia. Twenty-four of the women, finding sufficient relief from one injection, refused further treatment, though they still had some slight pain. Only four very nervous women seemed refractory to the drug. Though they claimed that they had no relief, their complaints and screams became less noisy.

The length of the analgesia is very variable, the extremes being 30 minutes on the one hand to 12 hours on the other. There was not a single ill effect on the mother during labor or the puerperium; and though the hysterograph showed the uterine contractions to be unaltered, the second stage of labor was somewhat lengthened, probably due to the lessened use of the abdominal muscles following the injections. Often in cases of rigid cervix the first stage is shortened.

The 112 labors resulted in 115 babies, 77 of whom at once cried out; 28 were born dazed, like Cesarian section babies, but they had good color, regular forcible cardiac action, normal reflexes. This meant that after a little artificial respiration they would all breathe normally and they did. One child died during labor, but the fetal heart sounds were inaudible on admission to the hospital. All others, after respiration was established, had the same chances as other new-born infants.

This drug tocanalgine is given in doses of 1½

ccm. for the first injection and ½ to ¾ ccm. for succeeding doses.

Due to existing international conditions I could obtain only a small quantity of this drug to date and have so far tried it in only three cases with the following results:

All three patients were primiparæ—one was 36 years old. Two cases received 2 injections, one case 3 injections. Unfortunately, all three were given pituitrin. Two of the patients were entirely relieved of suffering, one very much relieved.

One mother suffered from thirst and frequent micturition. There were absolutely no other untoward symptoms in the mother during labor or puerperium. The women were not exhausted at the end of labor, the uterus involuted promptly, convalescence was in every way smooth, the flow of milk was as it should be. There were no headaches, nausea or vomiting or other uncomfortable sensations, at any time. The second stage of labor was certainly prolonged in all three cases. It does not seem that the uterine contractions were stopped, but they were certainly lessened in frequency and intensity, necessitating, as I have stated, or at least so my house gynecologist thought, pituitrin in the three cases.

One baby cried out at once, one took 4 minutes to cry out and one 8 minutes. But after that they all did perfectly well and at the end of the twelfth day left the hospital weighing more than at birth.

In conclusion let me say a few words comparing this "tocanalgine obstetrique" with scopolamine-morphine. They both act on the central nervous system. Tocanalgine works in 15 minutes; scopolamine takes 1 to 3 hours to establish amnesia. Both fail in a small percentage of cases. Both are harmless to the mother in labor and puerperium. Both prolong the second stage of labor, but if this prolongation is not excessive it is rather a benefit than a harm. Both cause oligopnea in a certain number of babies, but that should not deter us from the use of either drug. Though I am delighted with the results I have obtained to date in over 30 cases of "twilight sleep," I would welcome a drug that was just as safe to mother and child as scopolamine-morphine, and easier of manipulation. In the Freiburg method the memory test, not always easy to employ, must be the main guide and must be repeated every few minutes and the mother and child must be constantly watched. With tocanalgine the return of pain means that the effect of the drug has worn off and the patient needs another injection, and the first or a repeated dose can be given near the end of labor, as it works promptly and promises rapid relief. Although my three cases were not everything to be desired, they were much more successful and much more encouraging than were the first attempts in the method of Kroenig and Gauss.

2 WEST 86TH STREET.

TRANSFUSION OF BLOOD—SOME RECENT OBSERVATIONS.*

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Much has been written about blood transfusion. Many attractive theories have been advanced. Interesting articles have appeared, from time to time, dealing with almost every phase of the subject, especially of technic, and describing new instruments, some of which are so complicated and so stamped with the genius of the inventor as to be of little practical value to the busy general surgeon.

Although the indications for transfusion are numerous, it must be that new conditions will continue to arise, as we come to understand the blood more fully. By the introduction of new blood into the veins, some persons, though suffering from an incurable malady, have no doubt been given a few months longer to live, notably so in pernicious anemia and in the anemia of malignant disease. I have seen both these conditions apparently benefited by transfusion, but it must be done early, and repeated if necessary. Transfusion for acute infections in plethoric individuals is unwarranted. Long-standing infectious processes, attended by anemia, show improvement in some instances. The action of transfused blood in these cases is still theoretical. There is good reason to believe, however, that it increases phagocytosis and raises the opsonic index.

Not all anemic individuals are good subjects for transfusion. Each case must be carefully studied, especially as to the heart condition. If the second sound of the heart is not easily defined, and the pulse thready and irregular, one should transfuse cautiously, if at all. Accidental hemorrhage, for which we would perform a transfusion, sometimes occurs in the presence of certain constitutional conditions—diabetes, leukemia, nephritis—in which the heart muscle has been rendered unable to withstand the strain incident to sudden increase in the volume of the circulation. In case of fatal hemorrhage, death is probably not due to loss of blood *per se*, but rather to rapid deterioration of the heart muscle, the heart dying along with the rest of the body

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from lack of nutrition. We must not forget, also, that hemorrhage is sometimes beneficial. Some of our superiors still remember the magic effects of venesection, as practiced years ago. These splendid results were due largely to relief of tension upon the vasomotor centers, giving to the heart muscle a period of respite from fatigue. In the presence of marked blood impoverishment, and in great reduction of the blood volume by acute hemorrhage, the danger of hematolysis should not be overlooked. Hematolysis occurs in something like 25 per cent. of cases, and yet a long and extensive experience may not encounter a single instance. It is a mark of good surgical judgment, however, not to transfuse unless the blood of both individuals is found to be compatible. Some years ago when the study of the circulation was creating new interest, the opinion was held that death from hemorrhage was due to a sudden diminution in the quantity of blood and not to loss of red corpuscles, that no matter how sudden or severe the hemorrhage, the loss of serum was invariably out of proportion to that of the cellular elements, there being always enough red cells left to carry oxygen to the tissues, and furthermore, on such occasions, the mere introduction into the veins of sufficient normal saline solution to restore equilibrium would also save life. We know now, however, that while this theory was largely correct, it did not express the whole truth. There are instances in which, after serious loss of blood, saline instillation fails to save life. The heart rallies for a short time, it is true, only to again lose its grip. Something else is needed. Whole blood seems to supply this need. After abortions in tall, slender, relaxed individuals, with the uterus empty and hemorrhage persistent, sometimes for days, transfusion acts unusually well. Of course, there are other effectual means of treatment. But transfusion controls the hemorrhage by shortening the coagulation time, and supplies new blood.

By far the greater number of transfusions is done for some form of anemia, in which the patient's circulation has been either suddenly depleted by hemorrhage, or more gradually effected, as in the stillicidium of uterine fibroids, persistent epistaxis, hemorrhage of the newborn and frequent attacks of hematemesis. Then there is the group of cases in which some disease or foreign substance has altered the character of the blood. In this group are the malignancies, cirrhosis of the liver, illuminating gas poisoning, pernicious anemia and hemophilia. Besides these more common conditions, all of which have responded to transfusion, another indication is found in those diseases of obscure pathology of which idiopathic epilepsy is an example. The patient's circulation should first be depleted by phlebotomy. If one will transfuse these cases occasionally, perhaps twice a year, and note the effect, he will find that many of them will be relieved of epileptic seizures for a number of months each time. Since there is, as yet, no cure for epilepsy, transfusion ought to be tried. This applies more particularly to the individual case, in which there is a desire to relieve domestic tension and improve the environment. In institutional work, where hundreds of cases are treated, transfusion would hardly be feasible.

Like all other surgical procedures, methods of doing transfusion will continue to multiply until one or more are perfected which combine simplicity with rapidity and safety. Crile's method is used extensively. Brewer's tubes have given satisfaction. McGrath's rubber bulb apparatus should receive further trial. The same author's forceps-canula seems very simple in its application, but here again the matter of turning back a vascular cuff is tedious and often difficult. None of these methods provide any special means for measuring the blood. While it is not necessary to be so accurate about the amount transfused, yet it would seem best to operate within the limits of safety, noting carefully the effect. Some patients require only small amounts; others, more. A slender person should be selected as donor, if possible, whether arterial or venous blood is to be used. Healthy relatives are to be preferred, for legal as well as social reasons. Section of the radial artery, while exposing the donor to a slightly longer convalescence, is quite devoid of danger, only a small incision being necessary, when the simple canula, presently to be described, is used. Results are more certain also because of the driving power of the heart back of the column of blood. Of course, when an artery is severed, instantly its walls contract and retract, a wise provision of Nature in controlling hemorrhage. But this is offset by the fact that venous blood clots more readily than arterial, the coagulation time being shorter. The more tedious the process, anyway, the greater are the chances of failure.

In the *New York State Journal of Medicine*, July, 1911, I described a method of direct transfusion, with a simple means of measuring the blood. Since then I have used this method in a considerable number of cases with very good results. It is effective, quickly applied and requires only a reasonable amount of dexterity. However, when the donor is a stout individual with a large wrist, as is too often the case, there is some difficulty in making the artery

reach the vein without undue tension. On this account, I conducted a series of experiments to determine how this could be overcome. Without going into a close description of the many devices in use, it is safe to say that the two disturbing features which have occupied the attention of experimenters everywhere are hematolysis and early coagulation of the blood. The disposition of the first is in the hands of the operator. Evidently, many surgeons believe that whatever contrivance is used to convey the blood from one individual to another, its inner surface must, in some way, approach in character that of the living vessel (Crile), or be lined with paraffin, herudin or some other protective substance (Brewer, Percy, Satterlee and Hooker). While this may be desirable, I have not found it to be an absolute necessity. The great trouble with many of the finely adapted instruments for transfusion is that their application often is not possible in every case on account of inability to procure them. Lack of assistance and of skilled hands, also, being important considerations. Consequently, many persons, greatly in need of transfusion, are deprived of its beneficient influence.

After a number of tests covering all these points, I found that arterial or venous blood will flow almost indefinitely through an unlined rubber tube or a combined metal and rubber tube, if air is excluded and the conducting medium is kept at the body temperature by means of hot saline sponges; also, that blood collected from the canula does not coagulate any more readily than if taken directly from the vessels, the same conditions prevailing in both instances. Mere contact with a foreign substance, therefore, is not the main feature in the production of clotting. Exclusion of air and gentle manipulation are likewise essential. Paraffin seems to be unnecessary. As a matter of fact, the blood forms its own lining, as effectually protective as paraffin, by rapidly coating the inside of the tube with serum. This can be demonstrated by opening a tube through which blood has been passing for some seconds. The serum which adheres to the tube does not seem to favor coagulation, nor does it show a tendency to break up into particles to be carried along as emboli. On the strength of these findings, I now use two small canulæ connected by a piece of rubber tubing (fig. 1). The flexible rubber connection permits of rapid and more accurate adjustment.

We learned, however, that several things are necessary for easy and satisfactory work. The entire tube, or transmitter, should be as short as possible, not over five inches, and free from sharp curves and angular processes. A long tube (Aveling) means failure. When ready to make the anastomosis, the blood should not be exposed to the air, the vessels and tube having been kept warm and covered by hot saline sponges. Air does not easily penetrate a wet sponge. If blood is to be collected in the small graduate for estimating the amount to be carried over, it requires but a few seconds, after which the tip of the canula is wiped off and the hot sponges re-applied. The caliber of the tube should compare well with that of the vessels to be used. A very small tube produces too much tension, and one of large caliber permits undue commotion, of the blood stream, both of which favor fibrin formation and clotting.

The parts having been cleansed, the artery and vein, or both veins, are dissected clear and kept warm by moist sponges. Nerve fibers are carefully avoided. Provisional ligatures are thrown around the vein and artery in order later to fix the canula, and close the vessels when through. The artery is then severed, its distal end clamped or ligated, and the canula inserted and tied in. While the blood is flowing into a hot sponge, the vein is opened and the other end of the canula introduced and fixed. When the vessels used are both veins, they need not be divided. For obvious reasons, their distal and proximal segments, respectively, are connected with the canulæ. The anastomosis should be made quickly and with the slightest amount of traumatism. Air must be excluded. Even while the vein is being opened for the second canula, the artery, or other vein, should bleed into a hot sponge to prevent coagulation. The tip of the canula is wiped off before insertion.

We still employ the "spurt" method, referred to previously,to determine the amount of blood used. It is estimated in this way: When ready to make the connection, a small sterilized graduate is provided and the blood allowed to spurt into it till the drachm mark is reached, or any other point which may be decided upon. If five spurts are required to fill the graduate to the drachm mark, each spurt will contain twelve drops. A pulse of eighty, therefore, will discharge two ounces of blood a minute. This quite simple device is also sufficiently accurate. A trifling allowance is made for loss during the operation.

Arterial hemorrhage is a continuous flow, characterized by sharp, spurt-like exacerbations, due to systolic force modified by vascular tension. Blood coming from a vein has a long, open, undulating curve, comparable to a very slow pulse. The estimation, in

either case, however, can be made as above described.

There is no mystery about blood transfusion, although blood itself is a rather mysterious fluid. We analyze it, and determine pretty well the nature of its many constituents, but its physiology is not clear. No one knows just how it is that the same blood stream, rushing on like a mighty torrent, is equally able to construct bone and muscle, and to keep alive and keenly active the delicate brain cell. Hence the question has been raised as to the final destiny of blood transfused, whether it undergoes change, or immediately fulfils all tne requirements of the patient's own circulatory medium. In our experiments we could find no particular alteration except a tendency to enrichment. The recipient's blood, examined before and after transfusion, showed, in the latter instance, only an increase in normal constituents. I also tested a mixture of the two bloods, patient's and donor's, at the body temperature, both before and after transfusion, with the same results, except in the cases of pernicious anemia; here, of course, the abnormal elements remained in evidence. From my more recent work along this line, I have reached the following conclusions:

Fig. 1.

(1) That blood may be carried from one individual to another through unlined metallic or rubber tubing, maintained at the body temperature, without danger of clotting, if the anastomosis is made promptly. Long exposure of the field to the air and tedious manipulation are to be discouraged. The tube must be kept scrupulously clean. The blood serum adequately lines the tube.

(2) That the amount of blood passing over from the donor to the recipient may be accurately determined by knowing the donor's pulse rate, and the quantity discharged by a series of ventricular contractions.

(3) That the field of application should be enlarged to include any condition which might be benefited, even to a small degree. All things considered, the indications for transfusion may be left to the judgment of the operator, who should know something of bloodvessel surgery.

(4) That, in the absence of hemolysis, blood, after transfusion, is immediately taken up by the recipient and utilized as blood. If any change occurs, it is a gradual one, which has not, as yet, been determined. Further study of the blood is greatly needed.

(5) That our experience with whole blood preferably arterial, has been so satisfactory, that we have not often had to resort to the more complicated process of defibrination.

(6) That the method to be recommended is the one which requires the fewest assistants, creates the least excitement, fulfils the desired purpose and can be applied with the slightest disturbance to the blood contents.

(7) That blood transfusion is not, strictly speaking, a cure for any pathological condition, but rather a therapeutic help to other means of treatment. Its indication may even be replaced, occasionally, by saline instillation. Yet, there have been times when, death being imminent, when transfusion has seemed to be the one link in the chain of events without which a life would surely have been sacrificed. We, therefore, cannot take the unusual position held by some and dispose of transfusion as a useless procedure, nor vie with the enthusiastic worker, and recommend its practice too freely; but, with an open mind, as if searching for truth, we should carefully consider each case, in full view of the fact that blood is a complicated tissue about which there is yet much to be learned.

(8) That transfusion of blood is not devoid of danger; and while frequent performance improves the dexterity and skill of the operator, it does not relieve him of the peculiar responsibility which attends this apparently trivial operation.

A CONSIDERATION OF THE ANTISEPTICS USED IN THE TREATMENT OF INFECTIONS OF THE GENITO-URINARY ORGANS.

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Infections of genito-urinary organs occur from different sources and from different causes, and in consequence there are different kinds of infections. Gonorrheal infection is the most common, the most persistent, and often the starting point of urinary troubles. Other infections occur, frequently, however; for instance, in chronic cystitis, between the enlarged folds of an inflamed mucous membrane through the irritation of an alkaline urine, ulcerations are found which are very easily infected. The infection may be brought by continuity to the ureters and to the pelvis, causing pyelitis and pyelonephritis. An enlarged prostate is the cause of congestion of the mucous membrane of the bladder, and it often contains infectious materials in all degrees of inflammatory process, causing and spreading infection.

The infection may be limited to one part of the genito-urinary apparatus, or it may spread to the whole apparatus, from the urethra to the kidney.

Many pathogenic bacteria are found in the urinary tract, which, according to R. Kraus,[1] can be divided into two groups: In the first group are: 1, bacterium coli; 2, proteus Hauser; 3, staphylococcus pyogenes; 4, streptococcus pyogenes; 5, gonococcus Neisser; 6, tubercle bacillus; 7, bacillus typhi. The second group consists in the bacillus pyocyaneus, diplococcus Fraenkel and Weichselbaum, and some anaerobic bacteria referred to by Albaran and Cottet. In some cases those bacilli which in the normal circumstances are saprophytes do not produce any trouble, but in the presence of pathological alterations may become of a pathogenic influence, staphylococcus ureae (Rovsing), staphylococcus and micrococcus liquefaciens, flugge diplococci Bastianelli, and many others, which in some circumstances more or less will produce infection in the urinary organs.

Infection often is carried from outside by the introduction of instruments in the urethra either not at all or not sufficiently sterilized. In many cases the instruments, although perfectly sterilized, may stir up mucus or muco-pus in the posterior urethra and cause infection.

When a urethra has been infected with gonorrhea, this condition has much greater influence in the production of other infections.

Infections may occur by the way of the lymph and of the blood. In these cases pathological bacteria, which are found in those fluids, when carried to an hyperemic or inflamed mucous membrane of the urinary organs, may find good ground for their development in the mucous membrane itself and in the residual urine. The lymphatics from the intestines in close proximity to the urinary organs may carry a rich mess of bacteria and produce infection. Colon bacillus in urinary infections is more frequent and much more stubborn than at first considered. Adams[2] referred to sixty cases of infection of the urinary tract where colon bacillus was present. The results of this infection is bacilluria, which often causes pyelitis, chronic cystitis, and at times, pyelonephritis. On account of the stubbornness of these bacteria, there is a tendency to relapse, and more often to recrudescence.

The most important point before the treatment of infections of the genito-urinary organs is the prevention. When the rules of asepsis are strictly enforced infection can be avoided. When, however, we are in the presence of infection, it must be treated. We make use of two kinds of antiseptics, those which are taken by the stomach (internal antiseptics) and those which are used locally to wash and to cleanse the mucous membranes (local antiseptics).

The general internal antiseptics are those which, administered by the mouth and excreted with the urine, produce such a change as to convert it into a germicidal fluid. Salicylic acid has been used for many years, and more especially its derivate salol, which is still used with good results. Salol, decomposing in the upper intestinal tract into salicylic acid and carbolic acid, is thus absorbed and excreted in the urine, rendering it antiseptic.

On account of its being hard on the stomach, salol has been replaced by urotropin, which has today just attained great popularity. It is hexamethylene tetramin [(C H 2) 6 (N H 2) 4] and is obtained from ammonia and formaldehyde. Although having antiseptic properties, it is non-poisonous and non-irritant. It was introduced into urological practise by Nikolaier under the commercial name of urotropin. From the same base, combined with other antiseptics, we have helmitol (Bayer), and borovertin, when combined with boric acid; hetralin, cystopurin, cystogen, aminoform, are all the same thing under different names. All come from the same preparation and have in common the property to set free formaldehyde in the urine, which disinfects the urinary tract. In small doses it prevents the production of bacteria, while in

large doses it destroys those already existing. To a certain extent, hexamethylenamin has been recommended as diminishing pain and also as a uric acid solvent. Camphoric acid has also been proposed as a urinary antiseptic, and it has been combined with hexamethylin-tetramin in a preparation that has been recently highly recommended by Remete[3] as much more effective in producing disinfection and producing no irritation. In a series of cases where the urine was foul and full of bacteria, after using this drug it was found not altered and the bacteria were greatly diminished.

So far, at the present time, urotropin is the exponent of a large series of urinary antiseptics. Pfoundler and Schlossmann consider it a sovereign remedy for cystitis and pyelitis. Indeed, in chronic cystitis in the second stage together with the local treatment hexamethylenamin, as internal disinfectant, finds its right indication. Holt praises urotropin as an important remedy in the treatment of phosphaturia in children of all ages.

Thompson claims that urotropin alone is not so well tolerated, but associated with benzoate of sodium is much more effective. Indeed, Thompson, Still, Pardoe, and others, in cases of infection from bacillus coli, have not much confidence in the value of hexamethylenamin and they recommend the use of alkalies. In those cases where hexamethylenamin had been of great benefit, it had been administered in association with potassium citrate. Moreover, it is usually much more effective in chronic urinary infections than in acute cases, where the use of alkalies, antipyrin, salol, and the old chinin have proved of great value.

The use of the vaccines, especially in the gonococcic and colon bacillus infections, has been greatly praised. In my experience it requires much more study, and many more accurate observations.

The most reliable treatment for the genito-urinary infections is the local treatment, by means of irrigations or instillations, with local antiseptics. Irrigation is a powerful means to combat infections in the urinary tract. It is necessary to recommend perfect asepsis for the instruments and for the fluid to be injected, which has to be boiled before using.

By means of a Janet irrigator one can send into the bladder large quantities of an antiseptic solution, without any necessity of inserting catheters. If we do not need to send the fluid into the bladder, the application can be limited to the urethra by filling the canal, securing an even distension; when the inflow is stopped the fluid leaves the urethra by its contraction.

In my practice I am using, in cases of acute cystitis, irrigations with 2% solution of biborate of sodium; with its mild alkalinity it dissolves the mucus, cleanses the mucosa, diminishes the irritation, and at the same time has antiseptic properties. In many cases it is found useful in bladder irrigations, as it has no irritating property.

Where more powerful antiseptic applications are required, potassium permanganate is an excellent antiseptic. It is a powerful oxidizing agent because of the ready disengagement, in the presence of oxidizable matters, of a portion of the oxygen of the permanganic acid. By this property it promptly destroys fetor and putrid materials. In solution of from 1 to 5000, to 1 to 3000, it has a light claret wine color. When injected in these strengths into the bladder and the posterior urethra it is soon changed and is expelled as a grayish dirty fluid. The muco-purulent secretion is coagulated and is expelled as masses of dirty brownish strings. In my practice a mild solution of potassium permanganate has been found the most effective to combat infections of any kind. Formaldehyde in solution from 1 to 1000, to 1 to 500, is frequently used for irrigations with good results.

Picric acid, with its derivate picratol, has been used in solutions from 1 to 1000, to 1 to 500, in inflammatory gonorrheal urethritis, and in cystitis. It is an astringent and also a mild antiseptic. The results, however, have not been such as to warrant its use.

Aluminum acetate has been pointed out by Dr. Koll[4] as a useful antiseptic, especially in colon bacillus infection. With a series of experiments on the colon bacillus series and on the staphylococci, he could prove the bactericidal action of the drug in the strength of 2 per cent. solution. Clinically it gave good results in his cases; and in my service in two cases of severe chronic infectious cystitis, irrigations with 2 per cent. acetate of aluminum gave the most satisfactory results.

For instillations I have used solutions of 1 to 3 per cent. protargol, but more often of 20 per cent. argyrol. With an Ultzmann syringe only a few drops of argyrol are instilled in the prostatic urethra. Argyrol has a powerful coagulating property, and by it the muco-pus is coagulated in thick, stringy masses, which are easily removed by irrigations. Silver nitrate is also highly praised, but it is very irritant and painful, and in the ordinary cases argyrol gives good results.

Bichloride of mercury I find very irritating, even at the dose of 1 to 50,000. At this dose in my patients it has not produced any discomfort at the moment of the irrigation, but after a while it was fol-

lowed by severe pain and vesical tenesmus, and I have entirely abandoned its use. A great many of the recommended antiseptics under different trade names have as their base bichloride of mercury and it is better to be on guard in their use.

In concluding a short review of the modern antiseptics it must be said, again, that no antiseptic will have much value unless means to remove the source of infection are used. A good drain is obtained by the catheter left permanently in the bladder. A catheter left permanently in the bladder, draining infected urine, diminishes and removes fever, if present, and its beneficial effects are seen also in the ureters and on the renal pelvis. Through the catheter the bladder and the urethra are washed with the disinfectant solutions.

The removal of infected secretions from the prostate and from the spermatic vesicles by means of digital massage is often of great benefit, as in those organs infections are maintained and the urine spreads infection to the bladder and to the other parts of the genito-urinary tract. Likewise, if strictures are present, they must be dilated or cut.

As stated above, in cases of deep infection, the old stand-by, chinin (quinine), surpasses any other internal antiseptic, and repeated irrigations with solutions at different strength of potassium permanganate excel any other local applications.

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POPLITEAL SUPPURATION.

Pus escapes easily from the posterior chamber of the knee-joint along the azygos vein into the popliteal space. In the popliteal space it is shut in by the dense, tough popliteal fascia which forms a roof over it, causing it to travel by the way of least resistance up to the thigh under the hamstring muscles and down the leg under the gastrocnemius. The overlooking of the escape of pus or any infective material from the knee-joint into the popliteal space is very easy and its results, owing to its deep extensions, are very disastrous, often leading to the loss of the limb or to pyemia. I would strongly urge that it is better to make even an unnecessary incision in the popliteal space than run the risk of overlooking this escape.—EDRED M. CORNER in the *J. A. M. A.*

HEMORRHAGE FROM MIDDLE MENINGEAL ARTERY DUE TO TRAUMATISM; HEMIPLEGIA, MOTOR APHASIA; OSTEOPLASTIC FLAP FOR LIGATION OF VESSEL; RECOVERY.*

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Intracranial hemorrhage from rupture of the middle meningeal artery or its branches, due to traumatism, is a condition demanding serious consideration which the surgeon must be prepared to meet when least expecting it.

The diagnosis is not difficult if one has a clear history of traumatism and is able to watch or elicit symptoms from the time of injury until manifestations of cerebral compression are apparent. Occasionally, though, patients suffering from this condition are brought to the hospital with little or no evidence of trauma to the skull, in a state of stupor or coma, that many of the facts of the preceding history that might lead to an interpretation of the cause of the symptoms cannot be elicited. Fortunately for the patients, the physical signs, namely, effects of cerebral compression, which demand operative intervention, are so characteristic that they hardly admit of error.

A violent injury to the skull sufficient to cause a laceration of any of the intracranial vessels is generally followed by symptoms depending upon the situation and extent of the extravasation. This extravasation may be intracerebral or extracerebral. If intracerebral it may involve important centers and cause rapid death without giving symptoms of compression. If extracerebral, due to extravasation from the middle meningeal artery or its branches, a peculiar and characteristic sequence of symptoms follows the traumatism, namely: 1st, concussion; 2nd, free or conscious interval; 3rd, focal symptoms; and finally, 4th, symptoms indicative of general pressure such as (a) stupor, (b) unconsciousness, (c) slow pulse, (d) rise in blood pressure, (e) respiratory symptoms.

The focal symptoms are commonly at first irritative, shown by twitching of the face or arm due to the situation of the hematoma, generally over the lower end of the Rolandic area where the centers for the face and arm are situated. Furthermore, if the hemorrhage is on the left side motor aphasia is another characteristic sign.

Besides, from a laceration of the middle menin-

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geal or its branches extradural hemorrhages may take place from injury to the veins, sinuses, perisinoidal sinuses or emissary veins, the symptoms depending upon the amount, the site and the effects of pressure of the extravasated blood. The symptoms of pressure resulting from extravasation of blood may be of insidious or of rapid onset. The manifestation of compression occur when the extravasation has attained sufficient size to compromise the brain in the cavity of the cranium. When the extravasation takes place slowly there is a time —the free or conscious interval—which may be of short or long duration before symptoms of compression manifest themselves. Great importance must be attached to this classical and typical conscious interval between concussion and onset of symptoms of compression, as it is one of the most characteristic signs we have of middle meningeal hemorrhage.

On the other hand, the extravasation may be so rapid that coma occurs almost immediately without a free interval. The irritative symptoms may progress to those of local paralysis of the same centers and if the clot is large enough to extend to the centers of the lower extremity, which are situated higher up on the hemisphere, hemiplegia may result. This, however, is extremely uncommon. Cushing states that "instance of actual hemiplegia from an extradural hemorrhage must be rare, since the centers or the lower extremity lie so far away from the primary point at which an extravasation of this sort is likely to arise that a clot large enough to implicate the upper ridge of the hemisphere would in all probability either lead to such deep coma that symptoms of hemiplegia could not be appreciated, or else would cause death before they were apparent."

The patient whose case is here presented had a lesion of this type, of which there are not many recorded.

In spite of the progress made in the localization of cerebral affections there are some conditions in which it puzzles the operator to decide upon the exact place to open the skull. To determine the particular branch of the middle meningeal artery, anterior or posterior, which has been injured, is almost impossible, although schemes have been devised for finding points of election (Krönlein) for trepanation in hemorrhages from the different branches, should such be diagnosed. One can obviate this difficulty and uncertainty by making a large osteoplastic flap with its center over the main trunk. This seems quite rational, as it affords an excellent view for exploration for hemorrhage from the main trunk of the artery as well as its branches. With such an opening we can lift the brain and thereby expose the middle fossa of the skull, thus giving a good view for basilar inspection and removal of clots. In elevating the brain, there need be no fear, as the opening in the skull is sufficiently large to admit of dislocation of the brain with little danger of compression effects.

To one conversant with all the details of cranial surgery such a radical method is without danger and no more serious than exploration of the abdominal or any other cavity of the body. By following this plan in quite a number of cases we find this procedure a most efficient one for lesions in the fronto-temporal or tempo-parietal regions.

A male, 45 years of age, was admitted to my service at the Lebanon Hospital on October 11, 1914, with the history that two hours before, while watching a baseball game, he was accidentally hit with a ball. After being struck he felt dizzy, but quickly recovered therefrom and walked to his home, where after an hour he became unconscious, and the whole right half of his body, including his face, was found completely paralyzed. He had vomited a large quantity of dark material. When brought to the hospital there was a small hematoma over the left parietal region, but no depression could be felt. The right half of his face was smooth and lifeless. The left pupil was markedly dilated and did not react to light or accommodation. The right upper and lower extremity were paralyzed. Knee jerks, Babinski reflex, and ankle clonus were present on the right side. The left upper extremity was negative. On the left side the knee jerk was present, but only slight ankle clonus. The patient was unconscious. Lumbar puncture revealed sanguinous cerebro-spinal fluid under increased pressure. The pulse was slow and irregular. Respiration stertorous. Blood pressure 220 m.m. The history and classical train of symptoms, namely, traumatism, concussion, free interval, then compression symptoms, were typical of a rapid and large extradural hemorrhage, due probably to laceration of the middle meningeal artery or one of its branches. Accordingly a horseshoe incision was made in the left temporal region down to the bone. The skull was trephined in four places and the openings connected by means of the Gigli saw. The osteoplastic flap was dislocated downwards and a large clot, the size of the palm of the hand and over an inch in thickness, was removed. A fissure-fracture of the temporal bone was found close to the base of the skull. The bleeding was coming from the main trunk of the middle menin-

geal and it and a small vessel on the dura were ligated. The hemorrhage from these vessels was checked. The brain was seen to pulsate. There was no subdural hemorrhage over the exposed area, still there was considerable blood welling up from beneath, probably from laceration of some emissary veins, although no distinct point of hemorrhage could be discerned. The brain was gently lifted and considerable clots removed from the base of the skull. The space was gently packed with iodoform gauze to check the persistent oozing; the osteoplastic flap was replaced and the scalp was loosely sutured.

Forty-eight hours later, under narcosis, the old incision was laid open, the osteoplastic flap again reflected and the packing carefully removed. There was no more oozing. A small rubber tissue drain was inserted underneath to the base of the brain and brought out through one of the trephine openings. The flap was replaced to the original site and scalp permanently sutured. The rubber tissue drain was removed on the seventh day, when the wound was found healed by primary intention.

It was very interesting to watch the fall of the blood pressure during the operation. As soon as the bone flap was elevated the blood pressure gradually decreased so that when the operation was completed it had fallen from 220 m.m. to 110 m.m.

The clot was so large and thick that when it was removed one could plainly see the depression left in the region of the brain occupied by the hematoma.

On recovery from the stupor the motor aphasia and hemiplegia were markedly in evidence. From the time of the second operation these manifestations gradually disappeared, so that at the end of two weeks they were hardly noticeable. The patient was then discharged, fully recovered except for a slight headache.

The early operative intervention—about six hours after the injury—no doubt was the most important factor in this recovery. Had the hemorrhage continued and the clot extended so as to compress the important centers of the medulla, the outcome would not have been so successful. Indeed, one week later in an almost similar case, where I performed the same operation for an almost identical lesion, the outcome was not so favorable, as the hemorrhage was so rapid and the clot so extensive that the patient died six hours later from compression of the medullary centers. The autopsy showed a large clot underneath the base of the brain pressing on the medulla oblongata.

The prospects of relief from a hemiplegia due to epidural hemorrhage are in inverse relation to the time elapsed from the traumatism to the operation interference, because the sooner the pressure on the delicate nerve centers is removed, the better chance of permanent recovery from the hemiplegia.

35 EAST SIXTY-FIRST STREET.

AN OPERATION FOR THE ELONGATION OF BONE.

REPORT OF A CASE.

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The normal asymmetry of the lower extremities is about one-half an inch. The difference is in favor of one side about as often as it is of the other, though most tables find that the right is the longer.

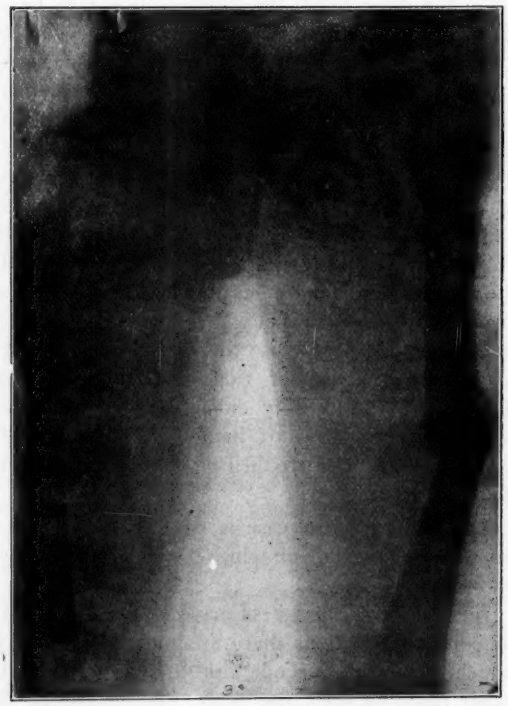

Fig. 1.

The pelvis tilts and compensates for even a greater difference between the two sides. From these facts we may conclude that the loss of an inch on the longer side when this was the longer by half an inch before injury, does not interfere with a good result, provided the fragments have united in line, since the normal difference has been preserved. However, one-half an inch would give rise to limp-

ing when the fracture occurs in the shorter limb under similar conditions. Oblique fractures with overriding and an angular displacement give even worse results in the shorter limb. A bone graft centrally placed is the best method which has been employed to bridge defects and lengthen the long bones. Much of the new bone that fills in and reinforces in this method of repair must go through the intermediate stage of cartilage formation, which is a rather long-drawn-out process of bone repair. This method requires absolute fixation of the fragments, as even slight motion would tend to cause absorption and prevent union. While this

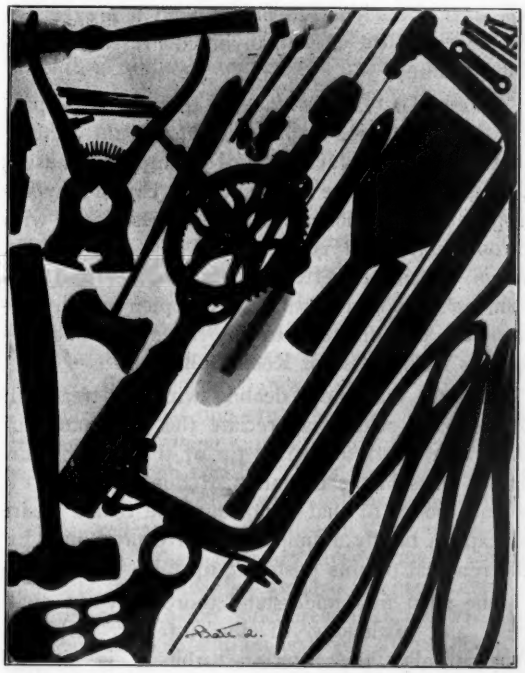

Fig. 2.

method covers a wide range of cases, the method which I am about to describe has proven very satisfactory in selected cases of angular deformity and shortening of long bones as a result of fracture. The following case illustrates this operation.

E. B., seven years old, family history negative. She broke her left leg at five and a half years of age; the bone united readily. While playing in the street three months ago, she fell and broke her right thigh; this was put in a splint and union took place with deformity. When I saw her three months after the injury, she walked very lame. The right leg measured one and a half inches shorter than the left and showed an angular deformity. The lower fragment turned inward, making an angle with the upper fragment of 15 degrees; there was also some rotary displacement. Figure 1 shows the deformity with the fragments overriding about an inch.

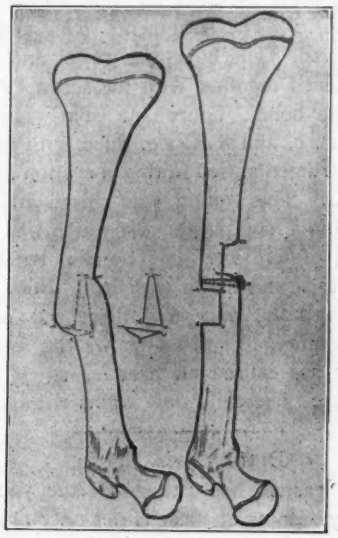

Fig. 3.

I made a linear incision over the outer side of the thigh and carried it down to the bone at the point of fracture, and freed the bone from the soft tissues. The saw shown in figure 2 was used to

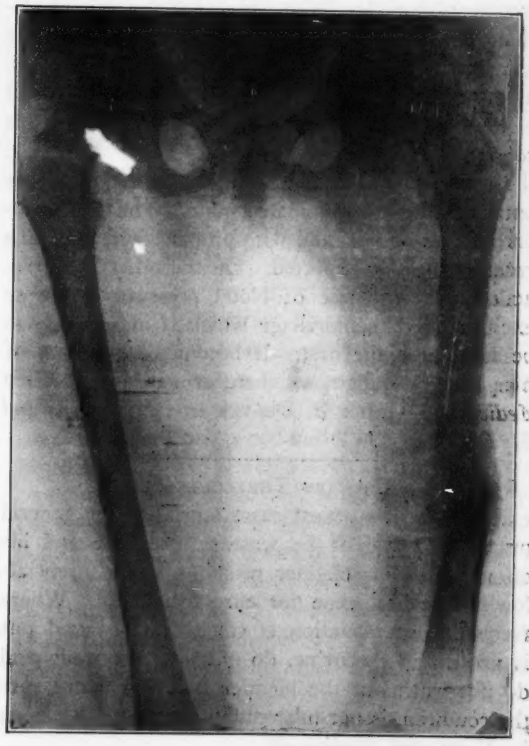

Fig. 4.

make the section of the bone. It is so constructed that the blade can be set at any angle with the plane of the frame. In this case it was set at 67½ degrees. I made the bone incision, shown in figure 3, *a.c.d.b.e.f.g.* The fragments *a.b.c* and *c.d.e.f.* were removed. The bone was re-set and its fragments fastened together with the screw *"s"* cut off close to the bone (figure 3). This also shows spaces *a.c.c'. b.* and *g'.e'. e.g.* filled with new bone. All the instruments used in this operation are shown in figure 2. The wound was closed and the leg was placed in a long plaster cast which was removed at the end of five weeks. The skin stitches were then removed; and union was firm. Both extremities measured the same and there was no appreciable deformity. Figure 4 shows the final result. The screw has caused no trouble, so it has been left in place. The child now walks without a limp.

DIEULAFOY'S ULCER.

Profuse gastric hemorrhage in the young with previous symptoms of ulcer is not uncommonly due to mucus erosions or hemorrhagic gastritis. The cause and pathology of these so-called Dieulafoy's ulcers are not clearly understood, but clinical experience shows that it is an acute condition, not ordinarily fatal, tending to clear up spontaneously and often followed by no sequelae of any kind. Gastroenterostomy has been advocated for this condition, but the evidence, in my opinion, does not warrant its use in every case. On the other hand, massive hemorrhage from the erosion of a vessel in the base of a chronic ulcer is a very dangerous condition and urgently calls for intervention. At the same time it is not wise to operate upon the patient in an exsanguinated state. The first hemorrhage rarely kills and with proper treatment some reaction may be expected. On the other hand, reaction with the rise of blood pressure is apt to excite a fresh hemorrhage which is more likely to be fatal than the first. It becomes a question of nice surgical judgment, therefore, to decide when to operate.—JOHN B. DEAVER in the *Long Island Medical Journal.*

URINARY TUBERCULOSIS.

Remember that most cases appeal to the general practitioner and, if he wastes their time and his effort in useless bladder washing, he is surely allowing the best time for cure to slip by. Where frequency of urination is complained of and pus is present in the urine, do not give urotropin and do not wash out the bladder unless you are sure the condition is not tuberculous.—G. S. WHITESIDE in *Northwest Medicine.*

THE SURGERY OF THE POSTERIOR TIP OF THE INFERIOR TURBINATE; THE RELATION OF THE POSTERIOR TIP TO CATARRHAL DEAFNESS AND TINNITUS.

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It is well appreciated that anything that interferes with the proper action of the tubal muscles, or anything that causes a chronic irritation to the Eustachian tubes, or anything that causes obstruction to the passage of air into the Eustachian tube, will have a tendency to bring about a progressive deafness and the accompanying distressing condition—tinnitus.

Among the various factors that cause a progressive diminution of hearing on account of their action on the Eustachian tube (mainly by causing a stenosis) may be mentioned a chronic hypertrophy of the mucous membranes associated with chronic intranasal conditions, i. e., sinus disease, polypi, chronic hypertrophic rhinitis, deviated septum, etc.; in the throat and nasopharynx, hypertrophied and diseased tonsils, adenoids, and adhesions in the fossa or Rosenmüller.

I believe that those dealing with the treatment of deafness seldom appreciate the importance of the rôle that the posterior tip of the inferior turbinate plays in the causation of this condition. It is on account of that important rôle that I desire to explain briefly a simple operative procedure for the removal of this posterior tip.

One must first understand thoroughly the anatomy and pathology of the inferior turbinate. Anatomically, the inferior turbinate is situated along the floor of the nose and is attached anteriorly to the superior maxillary bone, posteriorly to the inferior turbinated crest of the palate bone, and its middle portion articulates with the lacrymal bone and the superior maxillary. It extends from just within the free margin of the nostril almost to the nasopharynx, and is covered with a thick heavy mucous membrane of ciliated epithelium. The apparent size of the bone varies from time to time, due mainly to the action upon its mucous membranes of various irritants. This mucosa frequently becomes hypertrophied to such an extent as to cause interference with breathing, and this is particularly so of its anterior and posterior tips. The posterior tip is liable to undergo various forms of degeneration, mainly forming itself into a mulberry mass, which extends into the nasopharynx

and often encroaches upon the orifice of the Eustachian tube.

One can well see that a mass of this character, in this location, very often becomes edematous and, if sufficiently enlarged and irritated, that it can cause trouble to the various surrounding tissues. Not only does it act as an obstruction to the Eustachian tube, but it is very liable to cause an excess of secretion of thick mucus, which in itself may lodge in the tubal orifice and cause inflammation or obstruction.

According to the ordinary methods, unless one is very skilled, it is extremely difficult to remove the posterior tip. Many operators make it a point not to use adrenalin in these cases, for the edematous mass is liable to shrink to such an extent that it is difficult to remove. However, if one uses the technic which I am about to outline I am sure that he will not meet with many difficulties.

The nostril is first sprayed with a dilute solution of cocain and adrenalin. Two pledgets of cotton are soaked in this solution. One is placed underneath the turbinate against its attachment to the maxillary wall, and pushed back with an applicator. The other is placed over the entire mucous membrane of the turbinate. These are left in place for ten to fifteen minutes, and when they are removed the mucous membrane is sufficiently shrunken so that one can often see into the nasopharynx. By doing this, of course, the posterior tip is also much smaller. It is then our object to increase the size of this to such an extent that it can be well seen. A fine needle three inches long is attached to an ordinary hypodermatic syringe into which is placed equal parts of one-quarter of one per cent. cocain and adrenalin (1-1000). The injection of this solution is begun at the posterior two-thirds of the turbinate and is extended well back into the posterior tip. On account of the looseness of the tissue in this region one can balloon this area out sufficiently so that it can be readily seen.

An angular scissors is introduced, closed, beneath the turbinate and between it and the maxillary wall as far back as possible. By grasping the handle of the scissors firmly in one hand and placing the other hand on the top of the patient's head the closed blades are rotated inward until the entire turbinate is fractured from its attachments, when it will stand out at right angles. The closed scissors is now withdrawn and an incision is made into the turbinate at its posterior third deep enough to engage the tip of a wire snare. The snare is then introduced through the nostril to the nasopharynx, and the wire rotated outward until it is seen to pass over the posterior tip. It is then drawn slightly forward, the shank of the snare being pressed firmly into the incision formerly made. By closing the wire the posterior tip is firmly grasped and snared off. I have found Wright's pistol snare the best for this procedure. The rest of the turbinate is then placed in its former position, and a small strip of bismuth subnitrate gauze placed in the nostril, firmly against the cut surface.

Post-operative treatment is very simple. The patient is told to rest for the remainder of the day, iced cloths are put around the neck to stop the hemorrhage, and the following morning the gauze in the nose is saturated with liquid albolene until it comes out very readily. The patient is then given a spray of adrenalin and Dobell's solution.

I have seen the pathological part of a posterior tip present in many cases of beginning deafness, and have noted considerable improvement in this condition when the above outlined operative procedure was followed.

11 WEST 81ST STREET.

TREATMENT OF ACUTE PNEUMOCOCCUS PERITONITIS.

When a patient is seen suffering from acute diffuse pneumococcus peritonitis, every effort should be made to support the patient, and with proctolysis or continuous hypodermoclysis, Fowler's position, camphor stimulation, and the withholding of all fluids and solids by mouth, an attempt to tide him over until the acute stage passes. The localized abscess, whether subdiaphragmatic, pelvic, lumbar, or between loops of intestine and the abdominal wall, may be opened with comparative safety and effectively drained.—L. MILLER KAHN in the *New York Medical Journal.*

GASTRIC ULCER.

A plan which I have recently followed successfully appeals to me as sufficiently rational. After opening the abdomen and locating the ulcer, the stomach should be opened and the base of the ulcer inspected. If the vessel is seen it may be ligated directly by transfixion. If, as is more commonly the case, no erosion or artery is seen, a stitch of catgut should be whipped around the base as well as the edge of the ulcer with the object of occluding the vessels supplying it. The stomach may then be closed and a gastroenterostomy quickly performed. I liken this procedure to hysterotomy, of which I am a strong advocate.—JOHN B. DEAVER in the *Long Island Medical Journal.*

THE SURGEON'S REPUTATION.*

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One who worries about his reputation knows in his heart that he ought to worry about it. The reasons are apparent to him. Furthermore he cannot help himself in the matter. Explanation serves only to complicate matters. The situation is hopeless and disheartening, nothing being left for him excepting to continue worrying. On the other hand, one who worries about his character is in the midst of opportunities for helping himself daily, and the worry is transitory in duration.

There is a tendency always to be more jealous of reputation than of character. In the professions we are inclined to be jealous of each other and properly so, because of our high ideals, but our worry should be less about personal reputation than about personal character.

Recognition of a young practitioner comes first from colleagues and fellow workers. Those who are very close to a man are the ones best able to understand the significance and degree of his accomplishments. Public speaking and publication of ideas come next in order for giving a wider recognition, if one can make himself interesting without undue self-advertisement. A reputation that endures is based upon the foundation of appreciation on the part of colleagues, rather than upon ideas gained by a professional lay clientele. The superstructure of reputation never gets far above a base which can support it.

Practice is not to come from some indefinite imaginary point as many young men in the profession imagine. It is to come chiefly through old acquaintances, and in proportion as one has merited the respect of such close acquaintances. The three greatest social powers in the world are love, oratory, and propinquity, and of these the greatest is propinquity. The young physician who places himself near to objects of his ambition is apt to find himself drawn along without his conscious knowledge, toward the goal which he seeks.

When one first takes up the responsibilities of caring for human life and happiness it is apt to make him sleepless at night. He cannot do the best work after missing a good night's rest. Realizing that fact, I stopped being sleepless in 1883, when serving on the Bellevue staff as house surgeon. This is easily accomplished by one in normal health as a matter of the will, if he determines to stop all thinking upon retiring at night. It is best to take a lesson from the French doll. When one assumes a recumbent position his eyes naturally fall shut automatically like those of a French doll, and he may then remain like the doll until the next morning.

Members of the visiting staff at Bellevue were theoretically responsible for all of the people under my care, but practically my own responsibility was so great, with daily opportunity for mistakes in judgment that might cause death and suffering, that I found it difficult to rest. A little experience showed that the patients who were the cause of this worry had slept better than I during the night. An effort of the will was then brought to bear upon cessation of all thought at a certain hour, and this was accomplished without real difficulty.

We used to hear in former times about surgeons who "walked the floor late into the night" before doing some important operation. This kind of temperament is absolutely "impossible" for a surgeon of the present day. The patient should have been the one to walk the floor while the doctor was getting a good night's rest. The surgeon must be securely calm in his knowledge of what he is about to do,—or else turn the patient over to someone who is calm. Surgical work is almost certain to be done badly by anyone who carries a perturbed spirit into the operating room. Deaths are more often due to little errors in technic than to application of wrong principles.

Fame brings many complicated problems that require time for their adjustment. I would rather enjoy my pliant trout rod and the song of the hermit thrush, the fragrance of moist cedars and the beauty of a white violet in the soft green moss, than any combination of joys that fame can bring. I would not care to be great, because that incidentally takes up much time. Greatness is desirable in Nature's plan. No one admires great or famous men more than I do—if they are honest men—but personally it seems pleasanter to allow other people to have these things, which take up time that is precious for my own studies. I would rather be called plain Bob Morris by my friends than to be called any sort of a genius.

As one continues to maintain a position in the profession, the tendency is for more and more positions of trust to be placed upon him, and he must be constantly on guard against accepting too many. The desire for leadership is a matter of temperament, and brings responsibilities requiring a certain type of mind. When circumstances have placed me

* Advance pages from a book entitled "Wayside Notes" to be published by Doubleday Page & Company, New York.

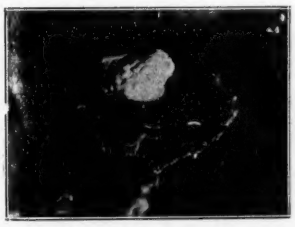
in positions that led step by step toward leadership, I have made an effort to escape. This plan would naturally not be followed by men of a different temperament. If a young man has qualifications and taste for leadership, duty will indicate that he follow that bent and play a most necessary part in affairs.

The time comes when one has added so many responsibilities to his list that it is practically impossible for him to take on one more, and yet it is difficult to avoid shouldering more than he can really manage well. I find the only way for obtaining mental relief is to emulate the guinea-hen, and she is now my symbol. A guinea hen will find a choice corner in the brush lot and soon has forty eggs in her nest. She cannot hatch all of them but she sits in the middle of the nest and hatches out all of the eggs that she can, and lets the rest go. The lesson taught by the guinea hen came to me as a great comfort.

CESSATION OF EPILEPTIC SEIZURES AFTER REMOVAL OF PREPUCE AND FIBROMA IMBEDDED IN URETHRA: CASE REPORT.

B. A. WASHBURN, M.D.,
PADUCAH, KY.

Male, aged 52, weight 180 lbs. Had been under treatment for epilepsy for fifteen years. His seizures were from one to six a month, accompanied by involuntary micturition.



His sight was good; he was constipated and had occasional headaches. No history of injury.

The foreskin, covering the meatus, was adherent on the right side behind the corona glandis. In the fossa navicularis the urethra was narrowed to the size of a filiform bougie by a tumor growing into it from the prepuce.

The foreskin was removed with the attached growth, which was found to be a fibroma (see photograph). Since this operation, two years ago, there has been no recurrence of the epileptic attacks.

A MODIFICATION OF PODALIC VERSION.

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The modification of podalic version here described is not applicable to all cases requiring version. It has been tried in about a dozen cases and they have partially proved the theory, but the method must stand the test of general usage. The idea was induced by the loss of time, frequent prolapse of the umbilical cord and consequent deaths to babies during version in a certain class of cases.

The cases where version is still practical but where there is enough of disproportion to necessitate considerable traction on the child's body for extraction are the ones referred to here. The ordinary procedure under such circumstances is to extract one leg and when it is found that much traction is necessary the accoucheur's hand is again inserted and the other leg is brought down. In this way the umbilical cord is often brought down and much time is wasted. The hand is introduced into the uterus when the lower segment is already under too great tension due to the head of the child being doubled against the body and the baby's other thigh and leg increasing the bulk. The head does not slip up well because of this and both external and internal manipulations are dangerous for the same reasons as pressure and friction on a tense perineum.

To partially correct the faults of the above method the following is submitted: Instead of bringing down one leg, the operator takes time to carefully straighten out both and to separate the cord from between the thighs. He then grasps both ankles with a finger between them, rotates them to the side or the anterior oblique diameter and draws carefully down in the pelvic direction. In this way much time is saved and the tension of the lower uterine segment is much lessened, due to the absence of the second thigh. For the same reason the head slips up more easily and no further internal or external manipulations are necessary. The cord does not come down because it is not looped around the child's thighs or legs. The extra time is taken during a comparatively safe stage. The objection that this method does not dilate the cervix as well as the other must receive consideration in the preliminary stretching of the birth canal.

Never apply an elastic ligature about the arm without first interposing a towel. This may obviate subsequent paralysis.

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WALTER M. BRICKNER, M.D., Editor

NEW YORK, JANUARY, 1915.

THE UNSETTLED PROBLEM OF PYLORIC OCCLUSION.

Experiences with gastro-enterostomy for pyloric stenosis due to ulcer constitute very apt illustrations of the remarkable tendency in the human body towards reformation of a physiological lumen. It has been found that, when food has been deflected through the new gastroenteric stomach for some time, the pylorus becomes patent again in not a few cases. The unused stoma then closes, in part or entirely, irritation of the ulcer at the pylorus results in a second stenosis, and the patient's symptoms recur. This rather schematic outline of the mechanics of some of the reported cases suffices to indicate the reason for, and the importance of, the many efforts made to permanently occlude the pylorus. Of course the ideal method is to resect the pylorus with the ulcer-bearing area. Even when feasible, however, this procedure is not always desirable because it adds considerably to the risk of the operation. The same may be stated for the operation consisting in division of the pylorus and suture and inversion of the cut lumina.

The first efforts towards simple occlusion of the pylorus consisted in the ligation with stout silk thread. It was soon found that the silk worked its way into the interior of the stomach and that the pylorus became patent in many instances. Although more successful, the method consisting in crushing and ligating the pylorus was also found unsatisfactory. This is not the place to review all the methods that have been employed to occlude the pylorus permanently. It is sufficient to state that none of them has had the full measure of success. Some recent encouraging efforts should be mentioned. Basing his work on uniformly satisfactory experimental results, Wilms performed pyloric occlusion, in several cases, with strips of fascia lata and reported completely successful pyloric closure. The operations have been performed at too recent a time to decide finally upon the method; unfortunately, however, an unsatisfactory result has already been reported by another observer. In a recent contribution,* Strauss describes ideal results, in a series of experiments observed during a considerable period of time, by shelling out the pyloric mucosa (through an incision of the muscularis) and ligating it with a strip of fascia. It is very doubtful, however, if this operation will have any great practical possibilities, for it presupposes normal pyloric tissues and a quite bloodless layer of cleavage between mucosa and muscularis.

It is evident, however, that the very important problem of securing an adequate and permanent occlusion of the pylorus is still far from solved. Perhaps its solution will be found by some simple modification of already proposed operations.—H. N.

*Journ. of the A. M. A.

THE PHYSICIAN AND ACUTE OSTEOMYELITIS.

The surgeon has visited upon the head of the physician much blame for his tardiness and temporizing in cases of appendicitis. The physician has merited all of the criticism that has been heaped upon him, and even then he was, perhaps, let off too lightly.

The same may be said of the physician's relation to gastric ulcer, duodenal ulcer, perforating typhoid ulcer, apoplexy, empyema, metrorrhagia, and "rheumatism." Indeed, as we look over the catalogue of human ills, it is difficult to find one in the treatment of which the surgeon might not render aid.

In some of these diseases, conditions develop which surgery would cure, but which without the surgeon often go on to healing. In others the treatment which the surgeon applies results disastrously. Still, in all of these conditions if modern surgery were applied the chances of recovery are better than without it.

Acute osteomyelitis belongs in a class by itself. It is wholly surgical. The physician has no business with it for a single minute. This can scarcely be said of any other disease. Even cancer is not

wholly surgical; the surgeon often can do nothing more than the physician. But with acute osteomyelitis the surgeon can always do something.

There is but one treatment for this disease. As soon as the infection occurs and begins to make pressure within the bone, the damage begins. To relieve the pressure in the medullary cavity and secure drainage through its bony sheath is imperative. Unless this is done promptly, the infection and inflammation, confined under the pressure of non-yielding bone, cause necrosis of more medulla, death of the bone, and absorption into the general system of the products of the infection. Most important among the latter are the infective organisms themselves. Metastatic foci develop, and to the local destruction is added a virulent general infection which threatens the bones, joints, the valves of the heart, and every other structure in the body.

These are the cases which come to the surgeon from the physician after having been treated for "rheumatism" or what-not. Necrotic bone, metastatic abscess, arthritis, and endocarditis have all developed often before the surgeon sees the case. If modern surgery is applied as soon as the disease is recognizable, a simple trephine opening into the bone suffices to cure the disease. Without this the case goes on; and loss of bone, crippling of limbs, invalidism or death may be expected.

The diagnosis of most surgical conditions may fail even in experienced hands. Many surgical conditions recover without surgery. Some are aggravated by surgery. But acute osteomyelitis is most easy of diagnosis, even in its earliest stages. It invariably does badly unless treated surgically. Its treatment is so simple that surgery at its worst cannot do as much harm as the disease.—J. P. W.

THE McBURNEY INCISION.

The still popular gridiron incision is quite satisfactory for a simple appendicectomy; but one can never be sure that a presumably simple appendicectomy will not eventuate as a much more extensive operation requiring liberal exposure. Nor does the McBurney incision lend itself well to exploration of the gall-bladder, pylorus, etc., which cases of presumed chronic appendicitis so often require. To be sure almost any intraabdominal operation can be performed through any incision if it is large enough, and, of course, the McBurney incision can be enlarged in various ways. Those who use it as a routine, however, must often encounter otherwise avoidable technical difficulties and must often overlook conditions that would be obvious through the right rectus incision.—W. M. B.

DAMAGED GOODS.

Brieux' play, "Damaged Goods" (Les Avariés), has been splendidly instructive to the public of the widespread dissemination of syphilis and of its subtle dangers to the innocent. The medical data it presents are for the most part accurate and well chosen. There is one statement, however, in the first act, that is wholly incorrect. To his recently infected patient, insistent upon marrying within a few months, the doctor says that the children of syphilitics are apt to have hare-lip, club-feet and congenital hip disease. (We know of no "congenital hip disease." Probably congenital dislocation of the hip is meant.)

Such fetal malformations as hare-lip, club-feet, and dislocation of the hip are not stigmata of syphilis and have no relation to the disease. Mothers of children bearing these abnormalities, who read or hear of this unfortunate passage in the play, will probably suspect that their husbands and their offsprings are syphilitic. In the interest of the peace of mind of such mothers, even more than for the mere sake of accuracy, this passage should be corrected.—W. M. B.

Surgical Suggestions

Hard nodules in the prostate due to calculi may be mistaken for carcinoma. The routine radiography of prostatic cases will obviate this error.

After perineorrhaphy it is in most, if not in all, cases unnecessary to bandage the thighs together, as is so often done.

Inversion of the appendix stump into the bowel within a pursestring suture is unnecessary. Quite as safe and at least as free from the chances of forming local adhesions, is the quicker procedure of merely tightly ligating the base of the appendix with catgut, and cauterizing the surface and lumen of the stump with pure phenol.

The midline (linea alba) incision into the abdomen is always inadvisable (especially in the hypogastrium of multiparous women, whose tissues here are stretched and thinned), since, even when no drain is used, a hernia often results. Except when a hemorrhage or other emergency demands great haste the opening should be made to one side of the linea alba, *i.e.*, through the rectus sheath, retracting or splitting the muscle.

Surgical Sociology

Ira S. Wile, M. D., Department Editor.

MEDICAL FACTORY INSPECTORS.

The protection of workers in industrial establishments requires a high degree of enlightenment on the part of employers and employees. The mere promulgation of laws fails to secure the results intended. Industrial hygiene involves an interpretation of sanitation, hygiene, and medicine in the light of personal health, home environment, and industrial conditions. The type of factory inspector which has existed is hardly sufficient to guarantee thoroughgoing medical inspection of industrial establishments. While it may not appeal at the present time to the medical profession as a type of employment offering possibilities, there is little question that in the future medical factory inspectors will be needed.

At the present time, England and Belgium maintain separate medical divisions in their factory inspection departments (Bull. 42 U. S. Dept. of Labor). Their services are required for the purpose of making investigations of occupational diseases, supervising medical work in dangerous trades, and doing specialized work in industrial hygiene. In addition, there is a supplementary group of physicians whose function it is to examine minors and children, investigate industrial accidents, and control dangerous trades.

While medical factory inspection is virtually an undeveloped department of activity in most of the foreign countries, factory inspection itself is regarded as a special vocation and of high professional standard. The preparation for this work must necessarily be rigid and thorough for the preparation for such a life profession involves education and responsibility equal to that of law, medicine, or engineering.

In our country, owing probably to its youth and freedom, state service is not regarded as as highly desirable as in the older and more socially developed European countries. To serve the state is one of the ambitions of foreign youths. In this country, it is for the most part regarded in the nature of a supplementary resource or a transitory employment until some better position presents itself.

The assumption of medical work in various degrees and kind by municipalities, the states, and the federal government is all too frequently regarded by physicians as an encroachment upon their prerogatives and finances. It has not yet been recognized that civic medicine is opening the doors to unusual opportunities for medical men; and our medical institutions are failing to call attention to the vast number of collateral occupations that are now open to physicians who are willing to serve in employments requiring a medical education and that are as legitimately the practice of medicine as the daily attendance upon a small group of individuals regarded as private patients.

The activity of medicine and surgery is assuming a public aspect of wider significance than ever before. The entrance of medical men into public careers is to be hailed with delight. It means more efficient service, more educated public servants, and more scientific attainment in the field of civic hygiene which is so essential for the promotion of public welfare.

THE FEDERAL WORKMEN'S COMPENSATION ACT.

The enactment of compensation acts to justly lessen the burdens of injured workingmen has already been recognized in twenty-four states. The first act in the United States was the Federal Law of 1908. It has now completed the first five years of its operations and the report of its services is detailed in Bulletin 155 of the United States Department of Labor.

About 95,000 persons are covered by the provisions of this act, and there have been 42,290 accidents reported during the five years, of which 1,006 were reported as fatal. It is noteworthy that the mortality during each of these five years has been lower than in the preceding years, which is clearly indicative of the fact that the mere fact of compensation for injuries not due to negligence or misconduct tends to increase the care of workmen rather than to make them more careless.

Over one million eight hundred thousand dollars have been paid out as compensation. While all accidents are reported, provided that they cause disability for longer than one day, compensation is given only for accidents causing a disability in excess of fifteen days. Negligence or misconduct of the injured workmen prevented the compensation of only 109 injured workmen in five years.

The basis of compensation is the wages of the injured workmen, the amount awarded being the same as the rate of such wages during the period of disability not exceeding one year. In fatal cases, the amount of payment is equal to one year's wages of the deceased workman. Nearly one-half of the accidents compensated occurred to men in the employ of the Isthmian Canal Commission with its 25,000 largely unskilled employees working under conditions of unusual hazard.

The full worth of the Federal Law cannot be readily determined by reason of the fact that compensation for non-fatal accidents terminates as soon as the injured person has recovered sufficiently to permit him to resume work. Therefore, few data are available with reference to the results of accidents because of permanent partial disability. Similarly, there is little information as to the effects of accidents causing a disability for a period beyond one year. It is unfortunate that the Federal Law does not treat the problem of permanent partial disability on a different basis from disability from which complete recovery is possible. It is obvious that under such circumstances inadequate compensation must frequently result. For example, in the case of the loss of a right arm, the workman might receive less than $50, and in three

cases wherein the loss of both legs resulted, the average compensation was only $377.40.

Regardless of its shortcomings, however, the Federal Compensation Law has been of immense benefit to a large number of injured employees and their families. Furthermore, this law served properly as a stimulating, practical act for the reasonable consideration of the value of workmen's compensation acts to the states of the Union wherein such legislatiion had not been formulated. Future amendments will undoubtedly serve to correct the defects already noted and will tend to provide for an extension of the provisions of the act to all federal employees of whom three-fourths are not included under the provisions of the law.

In extensive social legislation along lines of compensation, this government is far behind the standards existent in foreign countries. Furthermore, state legislation has advanced so that at present many of the states of the Union have wider and more just laws relating to workmen's compensation than provided for in the Federal bill. It would seem to be a function of national government to point out the way for the various states to make adequate provision for the protection of employees. The recognition of the obligations of society to lessen the burdens from accidents might well be pointed out by the national government through adequate attention on its part to its numerous civilian workers. In the organization of our government with the sovereignty of states recognized as it is, it becomes difficult to establish uniform legislation. Probably, there is an advantage in this fact, inasmuch as each state presents its own problems and its legislation grows out of the educational enlightenment of its population. Wherefore, there are numerous social experiments constantly being developed, the outcome of which may lead to the formulation of the type of enactment which will afford the greatest justice to, and protection of, the industrial workers throughout the country.

Book Reviews

Surgical Diseases and Injuries of the Genito-Urinary Organs. By J. W. Thompson Walker, M.B., C.M. Ed., F.R.C.S. Eng., Hunterian Professor of Surgery and Pathology, Royal College of Surgeons of England (1907), etc. Octavo; 879 pages; 45 plates (24 in color) and 279 text illustrations. New York; Funk & Wagnalls Co., 1914

Thompson Walker's eminence as a urologic surgeon is sufficient to attract, and the excellence of this work is sufficient to hold, deep interest in his new book on genito-urinary affections.

With certain exceptions (vide infra) it covers the entire field of the diseases, injuries and malformations of the male and female urinary tract and of the male genital organs. It is not, however, encyclopedic in any sense, and is intended as a text-book rather than as a treatise in its broader meaning. The author therefore makes no pretence to include all the literature, but bases his work chiefly on selected recent publications and on his personal experiences. Indeed, he makes his own observations serve largely as the substance of his text, which is, after all, the desideratum in all practical medical textbooks of authoritative origin. Also quite in keeping with his text-book plan, Walker has adopted the anatomical rather than the pathological classification of diseases, and one must agree with him that this is better for the purpose intended.

One of the most striking and most helpful features of the book is its wealth of excellent original illustrations, including numerous beautiful colored plates. These assist the text in presenting what the author has carefully aimed to supply, clear pictures of the "living pathology."

In a review of the first edition of so important a book it is fair to our readers, and helpful to the author, to point out some of its shortcomings rather than to deal only in general description.

Appended to each subject is a selected bibliography. Since this list is in each case admittedly incomplete the references to the author's own publications appear unduly numerous. We note, too, that not sufficient care has been taken in the spelling of proper names; thus we find *Cautwell* for *Cantwell, McMurty* for *McMurtry* and *Moschkowitz* for *Moschcowitz.*

In the chapter on bladder tumors there is not the slightest reference to Beer's treatment of vesical papilloma with the "high-frequency" spark. This method, now widely practiced, has been before the profession for about five years. We are forced to conclude that Thompson Walker has no experience with, perhaps no knowledge of, one of the most important of recent contributions to urologic surgery.

Neither in the section of undescended testis, nor in the appended literature, appears the name of Bevan, although the operation as described includes the principle feature of the procedure that usually bears his name. The fixation operation described by the late Keetley of London and, a little subsequently, by Torek of New York, is not referred to; but perhaps the author, like many other surgeons, does not approve of it.

The section of cystoscopy is too brief for a work intended for students and novitiates. We cannot quarrel with the author for preferring his own irrigating and catheterizing cystoscope, but we believe that he should have described and compared a few of the other commonly used instruments.

The results of castration for testicular neoplasms are given from the statistics of Chevassu and of Russell Howard, without reference to the morphology of the tumors. This is confusing and unsatisfactory. More detailed data are available.

Acute and chronic gonorrhea are dealt with in considerable detail; so is syphilis of the bladder, of the kidney and of the testis; so, too, are balanitis and herpes preputialis. Yet chancre and chancroid are not described. This is an inconsistency, a strange incompleteness.

The clinical value of the work would have been enhanced, we believe, by the inclusion of separate chapters dealing with the routine differential diagnosis of renal and bladder affections; special preparations for major urologic operations; operative methods in general; the after-care and complications of major operations.

These, then, are some of the defects in a generally excellent, very interesting, altogether practical and, pictorially and typographically, exceedingly attractive book.

A System of Operative Surgery. By various authors. Edited by F. F. Burghard, M.S. (Lond.), F.R.C.S. (Eng.), Teacher of Operative Surgery in King's College, London, etc. *New Edition.* In five large octavo volumes; illustrated. London: Oxford Medical Publications. Henry Frowde and Hodder and Stoughton, 1914.

As compared with the four-volume first edition of 1909 this edition does not show a general revision. A change has been made in some of the authors and corresponding sections have been re-written. In Volume I, *The Principles and Technique of Aseptic Surgery* is now contributed by Percy Sargent; in Volume II, *Operations upon the Tongue* is now written by H. J. Waring, *Operations upon the Tonsil* by George E. Waugh, *Operations upon Malignant Disease of the Pharynx* by Wilfred Trotter. Volume III appears the same in both editions. Volume IV is devoted to the surgery of the eye, ear, nose, larynx and trachea. It shows minor changes made to include

recent advances. Gynecologic operations, which formerly also appeared in Volume IV, now constitutes Volume V, and this section has, indeed, been largely recast. Formerly written by BLAND-SUTTON and JOHN PHILLIPS, they now share the work with ANDREWS, LEEDHAM-GREEN, BONNEY, JELLETT, BELL, MAXWELL and LEA.

Abdominal Operations. By SIR BERKELEY MOYNIHAN, M.S. (London), F.R.C.S., Leeds, England. *Third Edition.* In two large octavo volumes of about 500 pages each; 371 illustrations. Philadelphia and London: W. B. SAUNDERS Co., 1914.

The second edition of this standard work, in one volume, was published eight years ago. In the preparation of this two-volume edition the entire text has been thoroughly revised and modernized, and considerably enlarged. It shows a careful study of all the recent literature and the inclusion of such of it as is important. Thus the index of names lists about 900 authors referred to.

Although entitled "Abdominal Operations," the work concerns itself, as before, only with operations on the stomach and intestines, the peritoneum, the pancreas, the spleen, the liver and biliary tract, and the subphrenic space. Operations on the urinary tract, the pelvic organs, the abdominal wall (other than for penetrating wounds), and herniae are not included. Nor is resection of the rectum described. In short, Moynihan devotes his work to those operations or types of operation that he practices.

The preliminary chapters, dealing with operative methods, preparation, after-treatment, etc., have been revised with the others, and include a brief description of Crile's anoci-association technique, which Moynihan has adopted.

Précis de Chirurgie de Guerre. By EDMOND DELORME, Medical Inspector General of the French Army. Duodecimo; 218 pages. Paris: MASSON ET CIÉ, 1914. Price, 4 fr. 50.

Of timely interest is this compact yet comprehensive volume on war surgery. The offensive and defensive types of war implements are all dealt with and the casualties produced are tabulated according to the region involved; the prognosis, course and treatment of the injury are then discussed briefly and clearly. Delorme dwells at considerable length upon the bone lesions. These he classifies according to the type and severity of the injury, presenting simple and adequate illustrations to explain the mechanism of fractures. He has employed with satisfaction simple and apparently satisfactory metallic splints for which he claims a particular usefulness in fractures of long bones near or involving joints. The condensed chapters on wounds of the thorax, the abdomen, the spine, the upper and lower extremities shed no new light, but their subject matter is well arranged and written with authority. Delorme has comparatively little to say about amputations, but he lays stress on the importance of combating hemorrhages, primary and secondary.

The volume is agreeably free from overburdening statistics. The appended charts for statistical and case study are well planned.

The Tonsils, Faucial, Lingual and Pharyngeal. With some account of the posterior and lateral Pharyngeal Nodules. By HARRY A. BARNES, M.D., Instructor in Laryngology, Harvard Medical School; Surgeon in the Department for Diseases of the Nose and Throat, Boston Dispensary; Assistant Laryngologist, Massachusetts General Hospital; Member New England Laryngological and Otological Society; Member American Laryngological, Rhinological and Otological Society. Octavo; 168 pages; 39 illustrations. St. Louis: C. V. MOSBY Co., 1914. Price, $3.00, net.

Barnes' monograph on the tonsils takes up in a very simple and complete manner the modern views concerning tonsils and the surrounding tissues of Waldeyer's ring. We agree with the majority of his conclusions, although in a few instances we might take issue with him. The most important chapters are those which deal with the development of the tonsil and its anatomy and histology.

The volume is profusely illustrated with excellent cuts, and forms a valuable addition to the various new works on the nose and throat.

Infection and Resistance. An Exposition of the Biological Phenomena Underlying the Occurrence of Infection and the Recovery of the Animal Body from Infectious Disease. By HANS ZINNSER, M.D., Professor of Bacteriology at the College of Physicians and Surgeons, Columbia University, New York, formerly Professor of Bacteriology and Immunity, Leland Stanford University, California. With a chapter on Colloids and Colloidal Reactions, by Prof. STEWART W. YOUNG, Professor of Chemistry, Stanford University. Octavo; 546 pages. New York: THE MACMILLAN Co., 1914.

Amidst the wealth of new works upon infection and immunity that have been published in recent years, this work stands conspicuous. It is the best that we have seen. It is a combination of lucidity and comprehensiveness such as we meet but rarely in any medical work. By writing each chapter as a separate unit, Zinnser affords a complete and indelible picture of those under discussion. At the same time, the critique of the vast literature which the author commands so easily is so admirable that the reader is never left in doubt as to what is fact and what is still debatable. The chapter on colloids is short, but sufficient to enable the reader to note the close relations between the reactions of immunity and of colloids.

Pathogenic Microörganisms. A Practical Manual for Students, Physicians and Health Officers. By WILLIAM HALLOCK PARK, M.D., Professor of Bacteriology and Hygiene, University and Bellevue Hospital Medical College, and Director of the Bureau of Laboratories of the Department of Health, New York City, and ANNA W. WILLIAMS, M.D., Assistant Director of the Bureau of Laboratories, N. Y. Health Department; Consulting Pathologist, N. Y. Infirmary for Women and Children. *Fifth Edition.* Octavo; 684 pages; 210 engravings and 9 plates. New York and Philadelphia: LEA AND FEBIGER, 1914.

This much-used manual is an outgrowth of the laboratories of the N. Y. City Department of Health and was published first under the title Bacteriology in Medicine and Surgery.

Part I, Principles of Microbiology, deals with the various microörganisms in general and with laboratory methods. Part II considers the individual pathogenic organisms in detail. Part III is devoted to Applied Microbiology, viz. the bacteriology of milk, water, air, the soil; disinfection; water contamination and putrefaction; milk sterilization; the disposal of sewage; and bacteria in industries.

The Germ-Cell Cycle in Animals. By ROBERT W. HEGNER, Ph.D., Assistant Professor of Zoology in the University of Michigan. New York: THE MACMILLAN Co., 1914. Price $1.75.

To those interested in the problems of heredity, genetics, of animal breeding and hybridization the morphological studies of the changes in the germ cells as set forth in this book, cannot fail to prove of the deepest interest. The maturation of germ cells receives less attention than the segregation of the germ cells in the developing egg which from the author's viewpoint deserves greater emphasis. Not a small feature is the appended bibliography of more recent literature bearing on the subject treated to which the author has richly contributed.

Case Histories in Obstetrics. Groups of Cases Illustrating the Fundamental Problems which arise in Obstetrics. By ROBERT L. DE NORMANDIE, A.B., M.D., Assistant in Obstetrics, Harvard Medical School, etc. Octavo; 516 pages. Boston: W. M. LEONARD, 1914.

This book is written by one who has been accustomed to teach obstetrics at the bedside. The case reports embrace practically all the usual experiences of a well-

trained obstetrician and set forth in a very lucid manner the important and vital considerations in the management of normal and abnormal pregnancies, labors and the puerperal state. It is no book for the student, but it is a distinct aid and consultant for the beginner in the practice of obstetrics. For the reader who may have a large personal experience in obstetrics there is much in the pages of this book that may serve to check up observations, elucidate certain points or even stimulate clinical interest, for the author has succeeded in presenting so many living cases from his private and hospital work.

Selected Papers. Surgical and Scientific, from the writings of ROSWELL PARK, late Professor of Surgery in the University of Buffalo and Surgeon-in-Chief to the Buffalo General Hospital. With a memoir by CHARLES G. STOCKTON, M.D. Octavo; 381 pages. Buffalo: THE COURIER CO., 1914. Price, $3.00, net.

This is a handsomely printed memorial to an eminent surgeon and gifted teacher, consisting of a selection from his many published articles, chiefly surgical, and a memoir written by his friend and university colleague, Stockton.

Progress in Surgery

A Résumé of Recent Literature.

Note on the Wounds Observed During Three Weeks' Fighting in Flanders. G. H. MAKINS, *Lancet*, November 21, 1914.

The wounds are in the main of very severe type; this appears to be dependent on the fact that they have nearly all been received at the short distance of about the 200 yards which separates the opposing trenches, and that many bullets ricochet and acquire irregularity of flight by striking the margin of the trenches. The type of entry and exit wounds is somewhat varied from those produced by the older Mauser and Lee-Metford bullets; there is certainly more irregularity in form and size. One especially striking form is that in which the central round wound has a slit passing from opposite sides, suggesting that the original opening has been enlarged with a knife for purposes of exploration; such wounds are seen mainly on prominent points of the body, such as the margin of the patella or over an outstanding tendon. The number of large stellate exit wounds is also great, the most typical of all being those on the dorsum of the hand. The difficulty of being convinced as to the production of large explosive wounds by rifle bullet, shrapnel bullet, or fragment of shell respectively is very great. The patients positively state many wounds to have been produced by rifle bullets, which offer no resemblance to any type wound.

The presumption that the occurrence of gangrenous cellulitis might become rare with the establishment of more rapid means of transport has not been substantiated.

It has also proved that this condition may develop as the result of a simple rifle bullet wound, and when this is the case the absence of the safety vent afforded by the larger shell wounds may render the extension of the infection a still more rapid process. With regard to the influence of delay in transport on the development of gangrenous cellulitis, this affects only the extent to which the process may have reached when the patient comes under treatment, and can hardly be assumed to favor its actual origination. Experience of the same disease in civil practice needs only to be recalled to emphasize the rapidity with which the infection gains ground and the unlikelihood that any local antiseptic treatment could effectually cut it short.

The influence of the mechanical factor in favoring the spread of the process is well illustrated by the fact that while it spreads readily from wounds involving the deep planes of the limbs, the condition is not observed to develop in wounds of the thoracic parietes, of the abdominal wall, the neck or the scalp. In the latter cases the wounds afford sufficient vent to prevent the development of the tension which favors the extension of the process.

The advent is not heralded by serious general symptoms, neither the temperature nor pulse-rate rises very high, and there is little pain. The most striking features in the later progress are sleeplessness, the development of extreme anemia, and a peculiar slackness in the tension of the pulse. The patients meanwhile make little complaint.

Locally the first signs are rapidly increasing edema; at first white, later large patches of bronzy redness of unequal depth of tint develop, while at the upper limit of the discolored area crepitation is palpable. The bubbles of gas are often sufficiently large to raise an elevation which suggests on inspection a small varix of a vein; this is often seen in the areolar tissue over Scarpa's triangle. The glands of the axilla or groin enlarge early, but they are hard, not very tender, and never reach a large size or suppurate.

After two or three days the portion of the limb distal to the wound becomes cold, pulseless, and gangrenous. The distal gangrene is of the arterial type. The limb in cases which survive long enough mummifies, and a very sharp line of demarcation develops. Some of these limbs are intensely black in color.

No satisfactory method of treatment has been discovered. Multiple incisions at the limit of advance of the process check it and bring it to a standstill, and some benefit has been claimed from the method of injecting hydrogen peroxide in the same region, although Makins has seen little to support the opinion. The adoption of this method, however, lands the surgeon in a serious difficulty, since in spite of the arrest of the gangrenous process the perished limb persists as a source of septicemia, hectic develops, anemia becomes extreme, and the patient succumbs before the opportunity for the performance of a secondary amputation arrives. A considerable difference exists in this respect, however, between the treatment of the upper and lower extremities. In the former a considerable proportion of the cases survive, while of the latter the large majority of the patients die from shock and septicemia during the next 36 hours if the amputation needs to be made through the thigh.

The Relief of Gas Pains After Appendicectomy. T. A. KENEFICK, New York, *New York Medical Journal*, November 7, 1914.

In fifteen successive cases, Kenefick has obtained complete relief by the following method: He administers 20 grams of acetyl salicylic acid ester, with fine grains of bicarbonate of soda and one grain of calomel, in two or four ounces of water the afternoon preceding the operation. This is followed by an enema the next morning. The dose varies with the age of the patient. If signs of distension appear after the operation, ten grains can be given the next day.

Experimental Pyloric Stenosis. W. W. HAMBURGER and J. C. FRIEDMAN, Chicago, *Archives of Internal Medicine*, November 15, 1914.

1. Moderate pyloric stenosis in dogs (ligature around pylorus tied loosely) causes little or no change in stomach mobility, acidity or size. 2. Marked obstruction causes motor insufficiency, continuous secretion (hyper-acidity) and hypertrophy and dilatation of the stomach. 3. Complete occlusion results in inanition, vomiting, convulsions and death of the animal in from 48 to 120 hours. 4. The pyloric ligature (stenosis) results in motor insufficiency with food retention, which in turn sets up a continuous secretion with the constant presence of free hydrochloric acid. 5. Pyloric obstruction with resulting motor insufficiency and continuous secretion are probably the most important factors in the production of chronic experimental ulcer. 6. While the foregoing results concern experimental chronic ulcer, it is more than likely that primary partial pyloric stenosis (from whatever cause) with secondary motor insufficiency and continuous secretion are largely responsible for the progression and delayed healing of chronic ulcer in man.

A New Diagnostic Sign of Appendicitis. (*Zur diagnose der appendicitis*). C. HORN, *Zentralblatt für Chirurgie*, October 3, 1914.

Horn's sign consists in pain caused by pulling the right spermatic cord. This sign he rated in 12 out of 15 cases. In obtaining the sign, it is necessary to avoid pressure upon the testis; the cord is grasped above the testis and gently pulled. The pain, according to the author, is due to irritation of the peritoneum in the neighborhood of the internal inguinal ring.

The Relief of Sterility by Means of Permanent Epididymostomy With the Formation of an Artificial Sac for the Storage of the Sperm. V. D. LESPINASSE, Chicago, *Journal of the American Medical Association*, November 28, 1914.

Lespinasse says that the types of sterility in a male are all cases of obstruction of the vas above the internal abdominal ring and almost all cases of obstruction of the ejaculatory ducts. His work represents seventy-nine operations. To try to relieve patients he experimented in three ways to make a sac to contain the glandular secretion; first by making the sac of the tunica vaginalis and then covering the cut surface of the epididymis and the contiguous surfaces of the testicle with a piece of thin rubber sheeting. Second, by making the sac entirely of this rubber sheeting sewed to the reflected capsule of the epididymis. Third, by removing the tunica vaginalis completely and placing the entire testicle and epididymis in a rubber bag. The technic is described as follows: "The tunica vaginalis is exposed as for an ordinary operation for hydrocele. The parietal layer of the tunica vaginalis is then cut, thus exposing the testicle and the epididymis. Epinephrin is now injected beneath the capsule of the epididymis, commencing at the top of the globus major and continuing down to the junction of the globus major with the body of the epididymis. An incision is made in the center of the epididymis commencing at the top of the globus major and continuing down to the junction of the globus major with the body of the epididymis. The epididymal capsule is now dissected off, thus exposing the epididymal tubules. The tops of these tubules are now cut off or hair threaded through them. The sac is made as follows: The rubber sheeting or tunica vaginalis is sewed to the reflected capsule of the epididymis in such a manner as to form a closed sac. The testicle is now replaced in the scrotum and suitable dressings applied. With the above-described technic we can produce a sac into which the sperm will discharge and continue to live. This sac can be tapped whenever sperm are desired for impregnating purposes. This operation will relieve all cases of male sterility in which there is a functionating testicle."

Operative Treatment of Acute Epididymitis. D. O. SMITH and B. H. FRAYSER, Canal Zone. *Annals of Surgery*, December, 1914.

Acute epididymitis warrants early surgical interference, these authors assert. Moreover, they claim that the extent of damage to the tubules is decreased by operation, that pain is relieved at once, and that recovery is made more rapid and complete. The evidences of a frank infection in acute epididymitis is so well marked in its local and systemic manifestations that there should be no hesitation to operate.

They advocate an incision in the tunica vaginalis, external and parallel with the epididymis, and large enough to deliver the testis. Multiple punctures are made in the inflamed parts of the epididymis with a blunt probe. These parts are gently massaged, washed with warm saline solution, and the testicle returned to the scrotum. A small gauze drain is used. A suspensory bandage is employed for support. The after treatment is simple.

[For many cases a small incision directly over the epididymis will suffice. A slender piece of rubber tubing makes a more satisfactory drain. The usual hot rectal irrigations should not be neglected. A "Bellevue" adhesive plaster bridge gives convenient support for the scrotum.]

Concerning Cystography. (*Ueber Zystographie*) O. ZUCKERKANDL, *Münchener Medizinische Wochenschrift*, No. 35, 1914.

The use of the X-ray for determining the presence of tumors within the bladder has, according to Zuckerkandl, not been popular owing to the simpler diagnostic help offered by the cystoscope. There are cases in which the cystoscope cannot be introduced into the bladder and others where no definite picture is elicited by the cystoscopy. In such cases Zuckerkandl has found the injection of collargol most serviceable. Inasmuch as the collargol shadow often embraces the tumor masses and conceals them, Zuckerkandl first radiographs with collargol in the bladder, then empties the latter and refills it with air. A second X-ray picture is taken with the bladder inflated and the contrast is most striking and instructive. Villous polypi of the bladder, pedunculated tumors of the bladder—infiltrating carcinomata and hypertrophied prostates are in this way brought into strong relief. In certain cases of large diverticulation when the cystoscope does not give complete pictures, this method can be supplemented.

Further Results in the Electrolysis Treatment of Cystitis. C. RUSS, London, *Lancet*, October 31, 1914.

"After the urine is voided a special catheter is passed into the bladder, but no lavage is undertaken. A few ounces of fluid are then passed in, and the catheter with a glass tube attached is fixed upright by a clamp; this makes a fluid system of the bladder, the catheter, and the tubing. The upper level of the fluid is seen through the glass tubing to rise and fall with respiration. A lint-covered metallic belt encircles the lower trunk at the hip level and is connected to one wire of the battery. The other wire (platinum) is passed down the catheter and conveys the current through the fluid to the interior of the bladder. Radiating from the perforations around the catheter eye numerous electric streams pass in all directions through the bladder and lower trunk to reach the metallic core of the belt. In this way we have an electrochemical action penetrating the bacteria and the entire vesical tissues. This action goes on for an hour or an hour and a half at each treatment. While the treatment proceeds the bladder is being gradually distended by the incoming urine and its recesses become exposed to the forces at work. The patients are unaware of the current's flow and recline at their ease, being occupied in reading and often also enjoy a smoke. If any pain or discomfort is felt it is certain that something in the arrangements needs readjustment."

There is gradual diminution of pus in the urine, with disappearance of the bacteria. Subjectively, there is diminished frequency of urination. As far as the experience of the author goes, the results are permanent. Russ believes the action of the electrolysis depends on a slow destruction of bacteria, with phagocytosis following congestion of the bloodvessels of the bladder. Its effect is therefore comparable to the Bier treatment of inflammations.

Extraperitoneal Rupture of the Bladder; Its Surgical Management. EUGENE FULLER, New York. *Journal of the American Medical Association*, December 12, 1914.

Severe violence in the suprapubic or perineal region may cause extraperitoneal rupture of the bladder, and the worst cases are those associated with fracture of the pelvis. It generally occurs in the region of the trigonum under the space of Retzius, less frequently above and at the side of the vesical neck. The injury is usually single and, if slight, may be treated expectantly, leaving the patient with nothing more than a corresponding area of pericystic sclerosis with slight or severe symptoms, according to the extent and position of the lesion. In most cases, however, expectant treatment invites a fatal result on account of the extravasation and burrowing of urine, which may involve the perinephritic region or even the thigh. There are no strikingly characteristic symptoms, and often the injury remains undetected until the inflammatory symptoms or burrowings attract attention. Hematuria follows the accident and may be slight or extensive.

In the former case there is sometimes no retention of urine. There is always pain, sometimes severe, on urination, but it may be masked by other pains following the traumatism. There is apt to be marked febrile disturbance. When seen promptly the differential diagnosis is between anuria, intraperitoneal and extraperitoneal rupture. In a case indicating bladder rupture seen at once the patient should be instructed to urinate, and if he can do so naturally and it shows no blood the chance is that the bladder is not injured, but if he cannot urinate a sterile catheter should be passed. If no urine appears, the probability is of an anuria from shock. The abdomen should be carefully watched, however, and after a little time the sterile catheter should be reintroduced and a measured amount of sterile normal saline solution be injected. If this is caught on the return flow, well and good; if not, the abdomen should be promptly opened and an intraperitoneal rent looked for and closed, if found. If not found, extraperitoneal injury should be looked for, a catheter introduced and the distention of the bladder watched. The addominal wound should then be closed and the bladder opened suprapubically and drained. If the bladder contains blood-clot, or if there is retention due to involvement of bladder neck or deep urethra, suprapubic cystotomy should be promptly performed, and if there is then any indication of rupture involving the peritoneum, any rents should be closed. If suprapubic cystotomy discloses extravesical rupture, and there is reason to believe that there is no great degree of urinary extravasation as yet, nothing further need be done than the drainage. In most cases prompt surgery has not been available, and if the burrowing has been enough to show externally it will be found that the bladder has been opened suprapubically or perineally, or perhaps both. An incision is usually made, draining off the pent-up fluid, and probably may save life, but it does not cure, as the drainage is only partial. Another error is in cases in which the burrowing point is far from the bladder and suppuration is then falsely diagnosed as local. Formerly Fuller has advised drainage of such pockets, and after this dissection to reach that pocket. He now reverses that process and dissects first. All these extravasations tend to point to the most dependent part and that should first be opened. It will then be found a much simpler matter to trace the track of the burrowing, and, when the limit of extension is located, an external incision can be made down on the end of a probe and drainage tubes introduced. More than one external connecting incision may be necessary if the burrowings have extended in more than one direction. Each step of the operation in these cases is described at length and illustrated in his paper. Three cases are reported.

Some Experiences with Alcohol Injections in Trigeminal and Other Neuralgias. WILFRED HARRIS, London. *Journal of the American Medical Association,* November 14, 1914.

Harris reports his experience with alcohol injections in neuralgia. He cautions against injection directly into a mixed nerve, such as the sciatic, on account of the motor as well as sensory paralysis it will produce. Many patients who have been thus operated upon have escaped paralysis by their good luck in the operator missing the nerve trunk and injecting around its sheath. He gives a case of his own experience which is instructive as regards this point. He has had experience with some two hundred cases of chronic trigeminal neuralgia. The first division is seldom involved alone, the second is usually also implicated. The supraorbital is the only branch of the first division Harris attacks. Attempts to reach the infraorbital branches he thinks dangerous and needless. The second division or superior maxillary nerves can be reached with advantage either at the foramen rotundum in the sphenomaxillary fossa, or at the exit of the infraorbital nerve on the cheek. In a majority of cases the pain is referred to the upper jaw and the nerve must be attacked at the foramen rotundum; this is difficult, while the other injection is easy. Harris uses two routes for this posterior injection; the first, and preferably, through the cheek in front of the coronoid process and behind the superior maxilla. If the coronoid process of the mandible comes too far forward or the antrum bulges backward, it may be hard to direct the needle between these parts and in front of the external pterygoid plate so as to enter the sphenomaxillary fossa. In such cases he tries to reach the nerve from behind the coronoid process, passing the needle through the cheek about 4 cm. in front of the middle of the internal auditory meatus on the line drawn from the incisura notch to the bottom of the ala nasi so as to pass over the bottom of the sigmoid notch on the lower jaw. With this the needle passes slightly upward and forward and the pterygoid plate is felt for. The injection of the third division at the foramen ovale is much more certain and easy. For this he uses roughly Levy and Baudouin's line. Full details of these methods are given, too minutely to be abstracted, as is also the injection of the gas-serian ganglion and the anatomical exceptions to the usual conditions provided for. In over sixty cases in which he has injected this ganglion he has seen in one slight diplopia due to sixth nerve weakness appear immediately and last for three months. In another case there was temporary vertigo and nystagmus for which he cannot easily account. Almost always Harris finds loss of taste occur immediately after injections of the third division of the fifth nerve confined to the anesthetic half of the tongue in proportion to the depth of the anesthesia. This lasts as long as the anesthesia and he has seen it two years after injection. This occurs immediately, proving that taste fibers from the tongue pass along to the gasserian ganglion via the third division. He has encountered two patients who suffered from paroxysmal neuralgia in which the paroxysms began in the throat or posterior palatal region on one side and spread into the ear and in front of the ear on to the cheek and down the side of the neck. In each case no relief was given by an injection of the third division of the fifth, and Harris considers these cases of geniculate neuralgia such as are described by Pierce, Clark and Taylor. Post-therapeutic neuralgia should never be treated by alcohol injection or any other operative measures, as it makes the cases worse even if they may appear at first to be relieved. He has seen decided benefit in chronic fibrositis and brachial fibrositis from alcohol injection. Migrainous neuralgia is rarely benefitted, but the post-influenza of periodic supra-orbital neuralgia may be sometimes completely cured by a single injection. It is in chronic trigeminal neuralgia that most cures are obtained.

Clinical Classification of Ethmoiditis. E. M. HOLMES, Boston. *Journal of the American Medical Association,* December 12, 1914.

HOLMES, discusses the clinical classification or ethmoiditis. It is needful, he says, that we should remember the important function of the ethmoid and middle turbinate in regulating the temperature of the respiration. When for any reason the middle turbinate and lower wall of the ethmoid have been sacrificed, it practically puts the patient in the condition of a mouth breather. In treating the ethmoiditis the most important thing is "to ascertain, so far as possible, the degree and extent of the existing pathologic conditions, to learn of the duration of the disease and whether there have been previous attacks, to consider the inconvenience of the existing ethmoid disease to the patient, the degree of extension into other structures and the inconvenience as well as the danger due to this extension. It is likewise of great importance to consider the patient's general condition, his hygienic surroundings, his habits and previous treatment, if any. After having gone over the individual case, unless we are sure that the whole ethmoid structure is beyond repair, I believe it is our duty to make the patient understand that it will give better results in his case to save all the nasal structures possible and tell him that in trying to obtain this final result several operations may be necessary." With this understanding we should do what seems necessary, even to the most thorough radical operation. We have to consider carefully the condition of the frontal and sphenoid cells and the effects of irritation from associated nerve filaments, especially the deptal. Holmes first divides ethmoid disease into two classes: the purulent and the

non-purulent. The latter may be either an acute or a chronic inflammatory condition, a degenerative, a syphilitic, a tuberculous or a neoplastic. The purulent may be either acute or chronic. Both types may occur independently or be associated. The acute inflammations are very common and usually associated with attacks of acute rhinitis, and in the majority of cases are self-limited. They are often difficult to diagnose, and when the drainage is not materially obstructed the symptoms are slight. If there is an associated purulent secretion coming from some of the ostia, the diagnosis is easier. While the majority are self-limited, some may become chronic, and we should be on the lookout. The general condition of the patient should be attended to, the gastro-intestinal tract kept right and the patient protected from exposure or fatigue. Locally much can be gained for diagnosis by a systematic application of cocain about the ostia, carrying it on a small-tipped applicator saturated with 5 or 10 per cent. solution directly to the anterior portion of the middle fossa under the tip of the middle turbinate. If this gives only slight or no relief, the next application should be made at the posterior end of the middle fossa, and after this the floor of the nose can be anesthetized and a thorough examination made. In an acute case in which the first application establishes drainage, the repetition of the treatment with the addition of argyrol is usually sufficient to cure the patient in a short time. There are cases in which this cannot give relief and more radical treatment is required. Chronic suppurations vary much in degree and severity of symptoms. The pus that flows backward into the pharynx may be distressing and very disagreeable when it forms decomposing crusts. Sometimes disturbances within the orbit may occur and pain be felt externally over the nose and in the temple region. Polypoid formation may exist for years without purulent manifestations. Unless there is thorough removal of the growth it is almost sure to return, and in advanced cases radical exenteration is required. Syphilitic disease may show the signs of a purulent ethmoiditis, and this should be kept in mind and, when discovered, operation deferred until specific treatment has been given. Neoplasms of the ethmoid are very rare and frequently beyond treatment when discovered. Any soft vascular tumor within the nose should arouse suspicion and receive immediate attention.

The Direct Method of Intralaryngeal Operation. CHEVALIER JACKSON, Pittsburg, *Journal of the American Medical Association,* November 28, 1914.

According to Jackson, the direct method is the only one for operating on the larynx in children; the indirect or mirror method is applicable only to adults. The difficulties of the direct method require long and constant practice in the operator but not nearly to the same extent as in the mirror method. No one method can be said to be best for all cases and all operators. The laryngologist should try all methods and instruments to learn which is the best for him to use. No anesthetic, general or local, is necessary for operations on the larynx in children. Cocain is dangerous in any case and general anesthesia is absolutely contra-indicated in all cases with even the slightest degree of laryngeal stenosis. Local anesthesia should be used in adults. General anesthesia, preferably ether, being required only when cocain is contra-indicated or when the ischemia accompanying its use causes the growth to shrink so as to hinder accurate removal.

A New Physical Sign in Certain Lesions of the Lumbar Spine. LEONARD W. ELY, San Francisco. *American Journal of Orthopedic Surgery,* October, 1914.

In various lesions of the lumbar spine, inflammatory and traumatic, if the patient be laid upon his face, when his knee is flexed his pelvis on that side will rise from the table. The exact reason for this phenomenon is somewhat difficult to understand, but it helps to differentiate lumbar from sacroiliac lesions, having possibly in the former the same value as Kernig's sign has in the latter.

Fractures of the Neck of the Femur; Its Treatment. JOHN B. WALKER, New York, *New York State Journal of Medicine,* December, 1914.

1. Fracture of the neck of the femur occurs under fifty years of age more frequently than was formerly believed.

2. Any injury to the hip followed by disability should suggest the possibility of a fracture of the neck, and requires an expert examination aided by an x-ray photograph.

3. Reduction of the deformity with complete immobilization of the fracture during the period of repair by means of a plaster spica bandage is advised in all suitable cases.

4. This is to be followed by early gymnastic movements, active rather than passive.

5. All weight-bearing upon the fracture is to be avoided for from four to six months, in some cases even longer.

A New Method of Hastening Repair After Fracture. H. J. KAUFFER, New York, *New York Medical Journal,* November 21, 1914.

Kauffer suggests the use of powdered bone mixed with petrolatum to the consistency of bismuth paste, which is injected between the divided ends of the fracture with the object of stimulating more rapid bone formation. The author has not tried his method in human beings, but in experimental work upon animals he claims that he has obtained more rapid formation of bone than in control animals.

Penetration Radiotherapy in Surgical Affections, with Special Reference to Surgical Tuberculosis. (*Zur Röntgentiefentherapie bei chirurgischen Krankheiten, mit besonderer Berücksichtigung der chirurgischen Tuberkulose*). J. OEHLER, *Münchener Medizinische Wochenschrift,* No. 40, 1914.

Formerly the X-ray was employed only casually in inoperable malignant tumors, in recurrences and after incomplete operations. Now the X-ray is used systematically in such circumstances and also in a great variety of other surgical diseases. The author has had favorable results in treating bone and joint tuberculosis, in abdominal and gland tuberculosis and tuberculosis of the epididymis; also in one case of actinomycosis of the jaw. Strumata were also favorably influenced in some cases, though the result was not as satisfactory as in tuberculous affections. Concerning malignant growths, those that are inoperable should and must be rayed; recurrences should likewise be treated by radiotherapy. But operable cases should and must be treated surgically whether it be carcinoma or sarcoma. The only exception is the superficial cancroid of the face, which is very amenable to the ray treatment.

Experiences in the Treatment of Malignant Tumors by Radium. RICHARD SPARMANN, Vienna. *Annals of Surgery,* November, 1914.

Sparmann reports his chief's, von Eiselsberg's, experience with radium in malignant tumors. Only *inoperable* cases were treated. In the beginning large doses of radium irradiation were employed; later much smaller doses, since it was found that the large doses produced destruction of healthy tissues in the tumor zone and that the patient's general condition suffered measureably. Of 52 cases treated, curatively as well as preventively, only 11 remained free from tumors. The writer is clear in his emphasis that recurrences were sometimes hastened by post-operative irradiation, that the general ill-effects, such as tachycardia, weakness, vomiting, were often distressing, finally that the dangers of hemorrhage or perforation of a hollow viscus were by no means negligible. For these reasons the author believes that the hopes placed in radium as a new and successful method of treating malignant tumors were not realized.

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CONTINUOUS ANALGESIA AND ANESTHESIA WITH SOMNOFORM—THE TECHNIC OF ADMINISTRATION.

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The use of highly volatile and rapidly eliminated anesthetics has immeasurably broadened the scope of the expert anesthetist's work in rendering the routine operative procedures of dentistry, minor surgery and the specialties, *painless*. Also the same agents and methods of administration serve equally well for brief periods of surgical narcosis, without the dangers incident to ether or chloroform and the occurrence of untoward post-anesthetic complications.

While ethyl chloride has been available as a general anesthetic for a number of years, its use for continuous analgesia and anesthesia by nasal administration has been deferred, owing to the lack of a suitable apparatus for its administration. The DeFord inhaler, devised and developed for the administration of ethyl chloride in combination with methyl chloride and ethyl bromide—*Somnoform* now provides the expert anesthetist with a simple, efficient and easily portable device for continuous analgesia or anesthesia.

Description of Apparatus.

The essential parts of the device, as illustrated (Fig. 1) are (1) a Capsule Chamber, in which the ampoules containing the anesthetic are fractured; (2) a Gauze Chamber to prevent the entrance of shattered glass into the apparatus; (3) a Rubber Bag to hold the volatized anesthetic; (4) a Regulating Valve, controlling the volume of the anesthetic vapor and the admixture of air; (5) a Nasal Cover, with a sponge rubber cushion to render it air-tight and adaptable to varying physiognomies, and an Expiratory Valve, controlled by a milled cap, by the turning of which rebreathing may be governed; and finally, (6) a Mouth Cover, used during the induction of analgesia or anesthesia, to avoid too great dilution of the anesthetic vapor by oral breathing. Attached to the tube leading from the anesthetic bag to the nasal cover, is a support to render the apparatus more stable, when strapped to the head, and allow the operator the freedom of both his hands. The mouth cover is adjusted to the proper position by means of an adjusting rod and set screw, and it may be put out of the way by letting it fall back into a slip-joint on the nasal cover.

Adjusting the Apparatus.

Assemble the appliance with the exception of the mouth cover. See that the lever regulating the valve is pulled down as far as it will go, this prevents the anesthetic from escaping. With the gauze chamber lightly packed, place an ampoule of somnoform in the breaking device, replace the top of breaking device and press upon it until a slight explosion is heard. The somnoform is now locked in the appliance and cannot escape till liberated.

Fig. 1. The DeFord Inhaler and Its Various Parts.

For operations on the teeth under analgesia the mouth cover is not needed. For removing adenoids, tonsils, etc., under analgesia the mouth cover is important.

For extraction of teeth, removing tonsils, adenoids, etc., under anesthesia the mouth cover is necessary.

Now adjust the appliance by placing it over the nose, fasten the strap around the head, and arrange the extra support to stabilize the apparatus.

When the mouth cover is to be used, with the mouth prop in position, slip the mouth cover over its retaining pin, adjust it on the rod so it covers the mouth accurately, and tighten the thumb screw. With the exhaling valve open to its fullest extent, anesthesia induction may now begin.

The Induction of Analgesia.

It is advisable to complete the painless part of all operative procedures before beginning the induction of analgesia. When all is in readiness the patient is allowed several breaths of air, then the lever of the regulating valve is raised slowly, and the anesthetic gradually admitted in increasing volume. The lever is raised until the lazy winking of the patient's eyelids indicates the onset of the anesthetic's obtunding effect. Only several more inhalations will then be necessary for an analgesia of brief duration. It is not desirable for the patient to lose consciousness. At this stage operating may be commenced, increasing the pressure and speed of the bur if no pain is felt. When a plane of satisfactory

analgesia has been reached, the regulating lever should be pressed down to shut off all or nearly all of the anesthetic. The beginner will do well to exclude all Somnoform at intervals, admitting a fresh supply of the vapor as needed. The expert, with increasing experience will be able to manipulate the regulating valve to admit just the required amount of fresh vapor to make the analgesia smoothly continuous. During continuous analgesia the depth of the obtunding effect is controlled, not only by the regulating valve, but also by the tidal volume of the patient's respiration. It is surprising how quickly patients accustom themselves to co-operate with the dentist, by lightening or deepening the plane of analgesia by increasing or diminishing their respiratory excursions. Also, when operating without the rubber dam, the lips may be closed at intervals to offset the dilutent effect of oral breathing. The supply of Somnoform vapor is renewed by fracturing fresh ampoules in the capsule chamber.

THE INDUCTION OF ANESTHESIA.

To induce complete surgical anesthesia, the anesthetic vapor is gradually admitted by raising the lever of the regulating valve. The rapidity with which this can be done will depend entirely on the reflexes of the mucous membrane in accepting the gradually concentrated vapor of the anesthetic. If the patient manifests no uneasiness, the lever may be rapidly advanced until the patient is breathing pure Somnoform vapor and exhaling it through the expiratory valve. Continuous anesthesia may require various degrees of rebreathing, which is accomplished by closing the expiratory valve entirely or partially, and by allowing the rebreathing of pure anesthetic vapor to and fro from the bag, or admitting varying percentages of air as the exigencies of the narcosis may require. The anesthetist who has acquired considerable skill in the use of Somnoform for short administrations will find the DeFord inhaler and the nasal technic a very satisfactory method of conducting anesthesias lasting upward to 15 or 20 minutes. Continuous anesthesia is preferable to repeated administrations, particularly if hemorrhage can be controlled and the patient kept from swallowing blood; a complication which usually results in nausea and cardiac depression from the diaphragmatic spasm during the efforts at vomiting. In the event of repeating the administration at the same sitting, sufficient time should elapse for the patient to fully recover from the first administration, and this interval should be used to cleanse the mouth and control hemorrhage to avoid spasm of the glottis from the weight of the accumulated blood. The aspirator is a valuable adjunct to satisfactory continuous anesthesia in all instances in which there is troublesome bleeding. The assistant should move it across the base of the tongue to keep a clear, bloodless field for the operator.

SIGNS OF ANALGESIA AND ANESTHESIA.

During analgesia the patient merely feels drowsy, the eyelids wink lazily, and there is some tingling and numbness of the extremities. The patient can talk, and is conscious of everything that is being done, but is insensible to the pain of light operating. He is able to assist the operator by moving the tongue or jaws, and clearing the mouth. With the onset of anesthesia there is loss of consciousness, muscular relaxation usually supervenes, the eyeballs roll upward, while the pupils noticeably dilate, and breathing becomes rhythmic and automatic as in sleep. As anesthesia deepens the dilatation of the pupil becomes marked, and the eyeballs become fixed, while the corneal reflex is lost and snoring or sterterous respiration supervenes. These signs denote the ultimate plane of surgical narcosis that is compatible with safety. Anesthesia continues to deepen for some 15 seconds after the last inhalation of the anesthetic vapor, and then elimination begins and is generally completed in about one minute, although there is a workable period of analgesia during recovery, which may be utilized to good advantage.

UTILITY OF SOMNOFORM ANALGESIA AND ANESTHESIA IN DENTISTRY AND SURGERY.

The progressive dentist is finding an ever broadening and more profitable field for the use of analgesia in the painful operations of dentistry, such as lancing abscesses, pyorrhoea technic, excavating sensitive dentine and removing pulps. Analgesia is sufficiently painless for all dental operations except the extraction of teeth and the removal of vital pulps surgically. Also it is invaluable not only in sparing the patient pain and nervous tension, but also in saving the dentist's time and enabling him to do more thorough work. Dental operations fail, not so much because dentists do not understand correct cavity preparation, proper tooth and root formation for crowns and abutments, and the necessity of thoroughly removing all calcarious concretions in pyorrhoea, but *without analgesia* patients many times will not endure the pain necessary to perform the operation thoroughly.

Somnoform anesthesia is also very serviceable in such operations of minor surgery as the opening of abscesses, tenotomies, removal of tonsils and post-nasal adenoids, aural, nasal and uterine polypi;

the application of the actual cautery, passive movements of stiff muscles and joints ; eversions of toe and finger nails, removal of external piles, drainage tubes; in curetage, dilating urethral strictures and reducing dislocations. While the use of a mouth-prop during analgesia is optional with the operator, a patient should never be surgically anesthetized with Somnoform for such operations as the extraction of teeth or the enucleation of tonsils and adenoids, without a mouth-prop being inserted between the teeth in advance of the induction of narcosis. Occasionally spasm of the masseter muscle is met with, and this complication may prove very annoying, even dangerous, unless this precautionary measure to conserve an open airway has been adopted. Also it is important for the tyro to remember that the regulating valve of the apparatus must be closed before fracturing a fresh ampoule in the capsule chamber, otherwise the patient, already anesthetized, would inhale an overwhelming volume of the anesthetic vapor. After the bag has been filled with the new supply of vapor, the lever of the regulating valve is gradually raised until the required percentage of anesthetic vapor and air admixture has been reached.

PRELIMINARY STUDY AND PREPARATION OF THE PATIENT.

The dentist or expert anesthetist, who is to administer any general anesthetic, may, with advantage, cultivate the habit of gathering for himself valuable information as to the patient's physical condition without the patient's knowledge. He may detect at a glance whether the patient is young or old, thin or corpulent, feeble or robust, nervous and excitable or calm and without dread, temperate or alcoholic, showing shortness of breath or normal respiration. Even serious impairment of the heart or kidneys may be suspected by the careful observer.

It is always profitable to note the degree of nervous tension, since this may influence the patient's conduct during anesthesia or analgesia. This is particularly true when fear leads to muscular rigidity, gripping the chair, locking the jaws, and opposing the anesthetic. Signs of intoxication in even mild degree should be carefully looked for, since anxiety leads many patients to take "a bracer" before entering the office; and even a small amount of alcohol may necessitate the use of much larger quantities of Somnoform to control the excitement stage of narcosis. Again, patients are met with who are in an absolute state of exhaustion from pain and insomnia, and in these analgesia and anesthesia may be readily induced, and occasionally persons in this condition pass into a profound natural sleep, after recovery from the anesthetic, from which they are with difficulty aroused, and which is very disconcerting to the anesthetist.

The extremes of age are no contra-indications to Somnoform analgesia or anesthesia, except that in the presence of arteriosclerosis due care must be exercised not to allow any imperiling degree of respiratory embarrassment to supervene, which might precipitate a stroke of apoplexy. Elderly persons who show prominent veins in the neck and temples must be anesthetized very gradually with plenty of air in the early stages. The same is true for plethoric and obese patients, who seem to require excessive oxygenation in comparison with

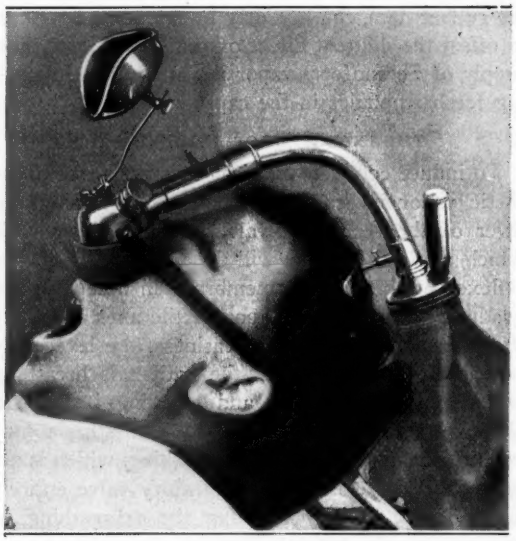

Fig. 2. Mouth Cover Elevated to Permit Operative Procedures.

anemic individuals. Nervous and frightened patients cause the anesthetist more anxiety and are really more hazardous risks than the frail and delicate subjects who present pathological complications, but have no dread of the anesthetic. During the induction of narcosis nervous individuals are subject to imperiling drops in blood pressure, due to psychic impressions, and their idiosyncrasies must be humored until the plane of light anesthesia has been reached. Should there be any question in the anesthetist's mind regarding the safety of administering analgesia or anesthesia to any particular hazardous risk, the respiratory test of Stange and the differential blood-pressure test of McKesson should be used to definitely determine the presence of acidosis and dangerous cardiac conditions.

It should be understood without constant repitition that in preparing a patient for analgesia or

anesthesia any tight clothes, collars and corsets should be removed. Women patients' statement that the corset is loose or has been loosened should not be accepted, but the nurse attendant should see that it is. It is also advisable that about three hours should have elapsed since the last meal.

The expert anesthetist will persuade the patient to yield without opposition to the induction of analgesia or anesthesia. The amount of self-control exerted by patients will be largely determined by the amount of confidence the operator is able to in-

Fig. 3. Rubber Dam in Use Instead of Mouth Cover.

spire. Nothing will so quickly place the patients at their ease as the realization that the operator knows exactly what he is to do and how to do it. Pleasant, diverting conversation also plays an important part in putting patients in a proper frame of mind for the ordeal of anesthesia.

POSITION OF THE PATIENT.

For many minor surgical operations and practically all dental operations the semi-reclining upright position answers all purposes. The head-rest should be so fixed as to tip the head slightly back, without stretching the neck or embarrassing respiration. The feet should rest comfortably on the foot-rest without the legs being crossed. The hands should lie limp, unclasped in the lap, so that they may be raised by the patient to indicate pain during analgesia or by the operator to determine relaxation at the onset of anesthesia. Providing that breathing is not interfered with, the patient should be put in that position which facilitates access to the field of operation. For operations, in which etherization is used as an adjunct to Somnoform, the horizontal posture is advisable; although with proper precautions and the use of the French chair-table, patients may be anesthetized in the horizontal and then operated on in any other desired posture.

The use of the aspirator to prevent the swallowing of blood during dental and oral operations has already been advocated, and it is also imperative for the operator to prevent anything else from dropping into the throat during anesthesia. Deaths in the chair from such accidents have occurred and operators, under the circumstances, have been mulcted of heavy damages.

CARE OF THE PATIENT DURING RECOVERY FROM THE ANESTHETIC.

Keeping the patient sitting back in the chair during recovery from anesthesia, and talking quietly and soothingly, will frequently overcome any tendency toward excitement and will prevent nausea. The patient should not sit up to wash out the mouth. It is more advisable to use the aspirator or to swab out the mouth. Also the patient may be allowed to rinse the mouth without raising the head. The patient should remain in the semi-reclining position until all effects of the analgesia or anesthesia have worn off and there is but slight tendency to nausea.

ACCIDENTS.

Somnoform analgesia and anesthesia have been singularly free from the usual accidents of general narcosis. It is very comforting, however, for the administrator to know exactly what to do in case any untoward accidents should occur. Experimental research has determined that in laboratory fatalities respiration has ceased several moments before the heart did. Consequently in clinical instances of embarrassed breathing immediate efforts should be made to re-establish respiration. The apparatus should be withdrawn, and sudden sharp pressure exerted on the abdomen. This stirs up the solar plexus and in most instances is sufficient to re-establish breathing. If not, rhythmical traction of the tongue, associated with artificial respiration by lifting the arms, and lowering them with compression of the chest, should be instituted, about 18 times a minute, and continued until spontaneous respiration returns. Meanwhile 1/100 gr. of nitroglycerin may be dissolved under the tongue, and amyl nitrite or aromatic spirits of ammonia held to the nose.

In cardiac collapse 8 or 10 drops of adrenalin in the conjunctival sac will usually cause a prompt and resuscitative circulatory response. Massaging the precordial area and lowering the patient to the horizontal or slight Trendelenburg posture will materially assist in accomplishing resuscitation.

CARE OF THE APPARATUS AFTER USE.

As soon as the operation is over, the gauze in the inhaler should be removed and thrown away, and the rubber bag and sponge cushion sterilized by exposure to dry heat or immersion in an antiseptic solution such as lysol, bichloride of mercury or carbolic acid. Both sides of the bag should be thoroughly dried and powdered with soapstone; all excess of the powder being then removed. Unless this is done the rubber bag and sponge cushion will rapidly deteriorate. All metal parts of the apparatus may be sterilized by boiling. Sterilization of the apparatus is an imperative prophylactic measure against the transmission of communicable diseases.

FLYNN BUILDING.

THE PROPER DEPTH OF ANESTHESIA.

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The purpose of this paper is to present evidence for the belief that the lightest possible anesthesia which will suffice for a given operation is the best. The injurious effects of general anesthesia may be grouped under two heads, (1) direct injuries due to the toxic action of the anesthetic upon the tissues, and (2) indirect injuries caused by the interference of the state of narcosis with physiologic processes. The most important of the indirect injuries are due to asphyxia and to muscular relaxation.

The harmful effects of asphyxia, the causes of this condition, and the means of preventing it are so generally known that it is needless to discuss them here. The same is not true of the harmful effects of muscular relaxation. In fact, many surgeons regard this as desirable, since it facilitates the performance of their work, and, as they believe, prevents so-called "surgical shock."

That full relaxation facilitates somewhat the performance of certain operations, especially laparotomies, we are prepared to grant, though we must deny that it is necessary. Instead of preventing "shock," we believe that muscular relaxation is an extremely potent means of producing it.

Before proceeding further let us explain what we mean by "light" anesthesia. To make this plain we shall describe our own practice. This has been developed gradually and largely through experience with nitrous-oxid-oxygen anesthesia. It was this which taught us the advantages and possibilities of a light narcosis.

Thirty minutes before the anesthesia is begun a hypodermic of morphia and atropine is given (average dose for adults: morphine gr. 1/6, atropine gr. 1/100). When the services of a skilled anesthetist are to be had we use nitrous-oxid and oxygen, otherwise, ether, given drop by drop on a mask which fits the face closely, is heavily covered with gauze, and has a considerable dead space. We insist that the patient be anesthetized without his becoming cyanotic or struggling. If his respiratory reflexes are so active that they render the maintenance of an open air way difficult, the anesthesia is gradually deepened till the anesthetist has his patient's respiration under control.

Difficulty in keeping an open air way is the only contraindication to light anesthesia, and it is surprising how seldom this is encountered, when the patient has been properly prepared. A short time after the patient has ceased to respond to questions the operation is started. Great care is exercised not to make sudden or violent traction on the tissues, and to employ sharp dissection whenever possible. The effect of each manipulation upon the patient is noted, and if necessary the operation is delayed a few moments until the anesthesia can be deepened. As far as possible the anesthetist is kept informed concerning the steps of the operation and the requirements of anesthesia. For example, during a laparotomy involving a resection of the intestine, once the segment to be resected has been located, very little anesthetic is administered till we are almost ready to close the abdomen. Then after the peritoneum has been closed no anesthetic is given during the remainder of the operation. We insist that the patient be practically awake before he leaves the operating room.

The foregoing description applies largely to the use of ether. When nitrous-oxid-oxygen is used there is no danger that the anesthesia will be too deep, provided cyanosis is guarded against. The depth of anesthesia which we employ corresponds to that of the ether "Rausch" of the Germans.

Post-operative ill effects from this light anesthesia, either from ether or nitrous-oxid, are almost entirely absent. Vomiting rarely occurs.

Nearly every patient except those who have undergone laparotomy is ready to take nourishment three or four hours after operation. In fact, we believe that an unprejudiced observer would say that the post-operative condition of these patients

is as good as that of similar cases operated upon under local anesthesia.

Our experience with this technic has now been of over six years' duration. We have found it to be adopted to all patients except the small class mentioned, and to most of these once they are got under control. We believe that it is so safe that its use renders unnecessary the combination of local and general anesthesia as a routine procedure.

Having thus explained what we mean by "light" anesthesia and having incidentally given the clinical results of the same, we must now return to our original questions, which are the consideration of the ill effects of muscular relaxation and the influence of deep anesthesia upon the production of so-called "shock."

It is a well known fact that the blood vessels are capable of holding several times the entire amount of blood. Since the arteries must always be full, it is evident that the veins and capillaries are not, and it is also evident that the mechanism by means of which the blood is prevented from accumulating in the latter vessels must be essential to life. That muscular contraction is the chief force involved in doing this is proved by the following considerations: (1) The veins of the limbs are provided with valves situated at short intervals apart and arranged so that every force that compresses the veins forces the blood toward the heart. When the valves become incompetent serious venous dilatation occurs, as in varicose veins of the leg. The mechanism just described is powerful enough to raise the blood pressure in the veins to several times the height of the arterial blood pressure, as we have shown by direct experiment. (Gatch—The Effects of Laparotomy on the Circulation. Trans. Am. Gyn. Society, 1914; in press.) (2) The intra-abdominal veins are destitute of valves, and since these vessels alone can hold more than all the blood in the body, something must prevent their filling. This is usually supposed to be accomplished by the vaso-motor mechanism. But that this alone is incapable of preventing a fatal stasis of blood in the abdominal viscera is shown by the following experiment: A dog is etherized till muscular relaxation is produced. Its arterial blood pressure is recorded. That its vaso-motor mechanism is acting well is shown by the maintenance of a normal blood pressure, and by a rise of blood pressure during asphyxia. The dog is now placed in a vertical head-up posture. The blood pressure rapidly falls and is soon almost to the base line. On placing the animal in the head-down posture its blood pressure quickly reaches the normal level. Salt solution is now injected into the animal's peritoneal cavity till its abdominal walls are distended. If the animal is now placed in the vertical head-up posture, little or no fall of blood pressure occurs. Similar results may be obtained by the use of curare. This experiment clearly shows: (1) The inability of the vaso-motor mechanism to prevent a fatal stasis of blood in the abdomen, and (2) the ability of an adequate intra-abdominal pressure to do so. Since this pressure is normally due to muscular contraction, the role of the latter is evident. Thus it is possible to produce fatal "shock" by deep anesthesia combined with the head-up posture. When we abolish muscular tone there is an accumulation of blood on the venous side of the circulation, and the effect of this is practically that of hemorrhage.

The writer is convinced from both clinical and laboratory experience that operating for ten minutes with the patient under profound anesthesia may do him more harm than operating for an hour under light anesthesia. During a prolonged period of complete muscular relaxation so much blood may be withdrawn from the circulation that all the tissues suffer from a diminished blood supply. This fact must be taken into account in estimating the toxic action of an anesthetic. This indirect action of the drug may be much more harmful than its direct toxic action.

1440 CENTRAL AVENUE.

NITROUS-OXID OXYGEN DOSAGE IN ANESTHESIA.*

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PROPORTION OF GASES IN TIDAL AIR THE ONLY AVAILABLE STANDARD OF QUALITATIVE DOSAGE.

The intensity of the anesthetic action of nitrous oxid is in a measure inversely as the quantity of oxygen with which it is administered. The effect varies from a blunting of pain sense, obtained by administration with percentage of oxygen exceeding that of normal air, down through increasingly anesthetic action, obtained by a percentage of oxygen half that of normal atmosphere; thence down through an increasingly anesthetic and asphyxial action, until finally, with a percentage of oxygen about one-third that of normal air, the asphyxial effect renders the mixture so dangerous that it may be termed unrespirable. The effect of dosage

*Read by proxy, courtesy of Dr. L. S. Booth, Anesthetist to Roosevelt Hospital, during the Second Annual Meeting of the American Association of Anesthetists, Atlantic City, June, 1914.

may therefore be tabulated within certain limits, according to the relative percentage of the two gases maintained for respiration.

GAS TENSION AS A FACTOR.

Additionally the anesthetic action of nitrous oxid is in a measure directly proportional to the tension of the gas dissolved in the arterial blood and central nervous system. Indeed any appreciable dilution of the anesthetic mixture by an inert gas such as nitrogen so lowers the volumetric proportion of normal atmospheric pressure sustained by nitrous oxid in the lungs and results in such low gas tension of nitrous oxid dissolved in the blood, that satisfactory anesthesia cannot be induced. In this connection the well-recognized increased anesthetic efficiency of nitrous oxid administered under a few millimeters of positive pressure can scarcely be cited as an illustration, since the clinical advantage accruing in this instance is no doubt due to the exclusion of air, which so often finds ingress into the apparatus through leaking joints, rather than to additional nitrous oxid dissolved in the blood. It is difficult to imagine that 5 millimeters of positive pressure would add an amount clinically appreciable to the 680 millimeters of tension, more or less, of nitrous oxid in the central nervous system of the anesthetized patient.

AN ACCURATE STANDARD AVAILABLE FOR THE HYDROCARBON ANESTHETICS.

With the lipoid solvent anesthetics, decreased oxygen supply is a secondary factor in the depth of anesthesia, the determining one being the actual vapor tension of such agents as ether, dissolved in the neurone. Therefore with these anesthetics, ether and chloroform, it would seem desirable, as urged by Boothby, to adopt a nomenclature of dosage referring to the barometric pressure exerted by the vapor in the lung and the tension under which it is held dissolved in the neurone.

NITROUS OXID STANDARD OF QUALITATIVE DOSE.

With nitrous oxid on the other hand since its efficiency is in larger measure proportional to the deprivation of oxygen, it seems desirable, until further work on the nitrous oxid tension of the blood has been done, to measure and tabulate dosage in terms of relative volumes of nitrous-oxid to oxygen in the inspired tidal volume.

LIMITATION OF THE QUALITATIVE DOSE STANDARD FOR NITROUS-OXID.

It must be recognized that the proportion of gases in the tidal volume is only an approximate index of the proportion of available gases which reach the central nervous system. Oxygen is perishable in the body, and must be constantly refreshed, whereas with nitrous-oxid, no loss being sustained, a partial clinical balance of blood and neurone with alveolar gas is established within six minutes, an almost complete balance within 15 minutes, and a complete physical balance within about 40 minutes, if analogy may be drawn from observations on carbon dioxid. Therefore, after a time it makes no difference with the amount of nitrous-oxid circulating in the blood what the tidal volume of respiration may be, so long as an equal gas pressure is maintained in the lungs. But for the oxygen of the blood to maintain a balance and the anesthetic state to remain in equilibrium, the oxygen intake in the tidal gas of respiration must remain constant in quantity within certain limits, no matter what the percentage may be. In other words, the percentage of oxygen must be raised to compensate for small tidal volume, thus upsetting the tidal proportion standard of dosage.

A second factor to upset the accuracy of dosage gauged by the relative proportion of gases in the tidal volume is an altered capacity of the blood to transfer oxygen. Any diminished rate of blood flow or diminished oxygen carrying power in the hemoglobin must be compensated for by increase in oxygen relative gas pressure both in the tidal volume and the alveolar air for the nerve cell to remain in anesthetic equilibrium.

Clinically it is found that the requirement of individual patients toward higher percentage of oxygen in the tidal volume is common when there is present any marked diminution of tidal volume or of quality or rate of blood flow. The tidal volume is often diminished by obstruction, by breath-holding, by acapnoea and by over-anesthetization.

The oxygen-carrying capacity of the blood is diminished by low hemoglobin content and by decreased rapidity of blood flow; or the carrying capacity of the blood for oxygen is much diminished by anemic and septic conditions; also the relative capacity seems to be lessened and the necessity for a higher per cent. of oxygen is evident in rapidly growing children and in patients of rapidly-increasing weight. The carrying capacity being in direct ratio to the rate and volume of the blood flow is lessened in asthenic states, such as old age, cardiac decompensation and conditions of disease. Any of these factors which decrease the oxygen intake by a lessened tidal volume, or decrease the oxygen carrying capacity of the blood by lessened hemoglobin capacity or rate of blood flow must be compensated for by increase of oxygen in the mixture administered to that patient.

As previously stated, the only practical place to measure the relative proportion of gases is at the intake in the inspired volume, however much this measurement may leave to be desired.

Yet in normal man of average tidal volume the effect of a given proportion of gases can be foretold to a nicety, and in the exceptions noted above the proper level is very quickly found. By the use of a measuring instrument of precision for quantity of each gas as it flows to the patient the administration for a given depth of anesthetic becomes almost a rule of thumb and an automatic procedure.

ZONES OF ANESTHESIA.

If it is conceived for purpose of observation and tabulation that the various stages of nitrous-oxid anesthesia, from slight blunting of pain sense to profound asphyxia may be plotted as on a surface into continuous areas, each marked by definite physical reactions and each induced and maintained by definite proportion of nitrous oxid and oxygen, then these areas may be termed *Zones of Anesthesia.*

The following chart I have tabulated as the average for normal man of good tidal volume. The mixtures and measurements were first made very accurately and automatically by a carefully calibrated anesthetometer, working on nicely balanced gas pressures. Later this was abandoned for a less exact but more practicable measurement by the writer's instantaneous gas flow gauges. For guidance in tabulating the slightly asphyxial zones I am indebted to Dr. Walter M. Boothby, for the analgesic zones to Dr. Charles K. Teter. The profoundly asphyxial zones were determined in part by Dr. James T. Gwathmey and myself on the dog. The remaining zones were tabulated from operative cases in routine anesthesia at the Roosevelt Hospital, New York.

These zones were all determined without supplemental narcosis. It may be mentioned in passing, as a point frequently overlooked or understood by the more fanatical devotees of nitrous oxid, that without supplemental narcosis for resistant subjects no zone exists in the range of true nitrous-oxid anesthesia, which is surgically desirable.

UTILITY OF THE ABOVE ZONES.

The Lethal Zone: Equilibrium can never be said to be established in this zone, as fatal asphyxia supervenes in from 3 to 6 minutes. While the percentages of this zone are in common use for short operations, such as extraction of teeth, yet the asphyxial mixtures of this zone should be abandoned for those which induce anesthesia more

ZONES OF NITROUS OXIDE-OXYGEN ANAESTHESIA IN NORMAL MAN WITHOUT SUPPLEMENTAL NARCOSIS

PERCENTAGE IN TIDAL GASES		ZONE	DEPTH OF ANAESTHESIA	DEGREE OF ASPHYXIA	DEGREE OF RELAXATION	COLOR	UTILITY
NITROUS OXIDE	OXYGEN						
100%	0%	LETHAL	COMPLETE	GREAT TO FATAL	TONIC & CLONIC SPASM	BLUE BLACK	EXTRACTION OF TEETH, INCISION OF ABCESS (USE CONDEMNED)
97%	3%						
95%	5%	PROFOUND	COMPLETE	CONSIDERABLE (DANGEROUS)	ASPHYXIAL RIGIDITY	DEEP CYANOSIS	
94%	6%	DEEP	COMPLETE	PARTIAL (DANGEROUS)	PARTIAL	MODERATE CYANOSIS	
92%	8%	MEDIUM	COMPLETE	PARTIAL	PARTIAL	SLIGHT CYANOSIS	INDUCTION
89%	11%	LIGHT	PARTIAL	SLIGHT	SLIGHT	FAINT CYANOSIS	ABDOMINAL SURGERY
86%	14%	VERY LIGHT	PARTIAL	○	○	NORMAL	SURFACE SURGERY (OR ABDOMINAL SURGERY WITH SUPPLEMENTAL NARCOSIS)
84%	16%	SUB-CONSCIOUS	PARTIAL COMPLETE ANALGESIA	○	○	NORMAL TO PINK	
80%	20%	LIGHT SUB-CONSCIOUS ANALGESIA	ANALGESIA	○	○	PINK	
50%	50%	CONSCIOUS ANALGESIA	EQUAL PARTS OF AIR ALLOWED			NORMAL	DENTISTRY

Fig. 1.

slowly and safely. Anesthesia induced by the percentage mixtures of the lethal zone subject the patient to severe cardio-vascular strain, and carry him to within a minute or two of death from asphyxia.

The Profound and Deep Zones also have no proper surgical indication. They are frequently invaded by error during the routine administration and are rapidly retreated from by raising the percentage of oxygen when oncoming asphyxia is observed. By intratrachael insufflation of the mixture a dog may be kept alive in the profound zone for half an hour. Man may be carried in the deep zone if the tidal volume be large and no asphyxial obstruction or thoracic fixation presents, yet the margin of safety is small.

The Medium Zone: The percentage of mixture, even in this zone is advisable only for the first few minutes of induction, as the zone yields an undesirable degree of asphyxia characterized by a slight cyanosis, occasionally muscular rigidity, by stertor, and by cardio-vascular strain. Some anesthetists utilize the physiologically disadvantageous asphyxia of this zone erroneously for additional degree of relaxation in resistant subjects. Relaxation cannot be secured in this zone in resistant subjects, but can only be secured by raising the percentage of oxygen and by supplemental narcosis; such narcosis as is attained by a small addition of ether.

The Light Zone: This is the one of greatest utility for abdominal surgery. The perfect relaxation of the hydrocarbon anesthetics is never present. Reflex muscular and respiratory reaction to trauma is always evident unless blocked by local analgesia or by a more effective general anesthetic such as small doses of ether or a large dose of morphine.

The Very Light Zone: This is the desirable one for surface surgery such as amputation of the breast. Both this and the subconscious zone may serve for all degrees of operative work when sup-

plemented by ether. In fact these are the ideal zones physiologically, since in these zones the blood pressure is not raised, the color is normal or even rose pink, the breathing is not exaggerated and there is no asphyxia present.

On the usual volume of delivery of from eight to ten litres of gases per minute, the percentages of oxygen in the gases delivered must be about two per cent. higher than that charted in Figure 1 on account of dilution with expired gases from which the oxygen has been in part absorbed. In patients who are anemic or toxic from disease or whose respiratory volume is small, or who have diminished blood flow, a higher percentage of oxygen is required to maintain the same oxygenation of the tissues. The percentages of oxygen needed in the inspired gases is approximately in direct ratio to the degree of anemia, or intoxication. For example, a patient with 50 per cent. hemoglobin or half the normal oxygen-carrying capacity requires for the zone of light anesthesia 18 to 20 per cent. of oxygen in the tidal volume of respiration, instead of the 11 per cent. mixture required by normal man.

The stimulus of operative trauma elevates the blood pressure 10 to 30 millimeters in all zones, even in the zone of profound anesthetic-asphyxia. Nitrous-oxid has not the slowly induced ether effect in blocking efferent sensations of the somatic nerves by direct action on the nerve ends. Nor does it compare in efficiency as to central nerve cell disassociation with full ether anesthesia. The maximum nitrous-oxid effect is about equivalent to the ether effect obtained by 30 millimeters of ether tension. Whereas full anesthesia under ether with complete disassociation of all the central nervous system from the great primative medullary centres is accomplished by 50 to 52 millimeters of ether tension in the central nervous system as has been shown in the anesthetic tension investigations of Boqthby. Therefore, nitrous-oxid provides no zone which protects against harmful stimuli of operative trauma as do the hydrocarbon fat-solvent anesthetics. Nitrous-oxid should therefore be employed only with the gentlest manipulation of tissue by the operator, or where there is supplemental blockage of centripetal stimuli by local analgesia or by a more effective general anesthetic such as ether, or deep narcosis by morphine or scopolamin.

QUANTITATIVE DOSAGE.

A consideration of dosage would be incomplete where a large avenue of excretion has been utilized and in part blocked, were not also the refreshing of the dose considered. In practice it is found that a refreshing of the gas at a rate about equivalent in bulk to the normal tidal volume suffices. I have never observed any ill effects from exceeding this rate, such as are alleged to arise from over-excretion of carbon dioxid. Excessive volume, however, is monetary waste.

A satisfactory level of anesthesia cannot be maintained unless the gaseous excrements such as carbon dioxid are washed out at a comparatively normal rate. No smoothness of anesthesia can be maintained on less than six litres per minute, and, in fact, 8 litres per minute (120 gallons per hour) should be placed as the minimal delivery, or to active individuals 10 litres per minute. The interrupted flow method, as set forth by Gatch and others, suffices for unconsciousness with intervals of exaggerated breathing (unless the respiratory center is desensitized by morphin), together with moments of asphyxia; but to maintain a definite level of anesthesia the supply of gases should be in continuous flow by the Boothby, or Teter method.

The working method which I prefer is to set the nitrous-oxid flowing through a Connell instantaneous gas flow gauge, at the rate of 8 litres per minute, the oxygen is set to ¾ litre per minute for induction. As soon as slight cyanosis appears, the oxygen is raised to 1 litre and in about 5 minutes to 1¼ litres. After 15 minutes it can usually be raised to 1½ litres per minute. If the patient is one requiring larger percentage of oxygen in the tidal air to establish anesthesia in the proper zone, this fact is promptly evident and the oxygen is increased. Rarely is more than 2 litres of oxygen per minute required.

NITROUS-OXID ANESTHESIA ADJUVANTS.

Owing to the intrinsically light character of nitrous-oxid oxygen anesthesia as previously stated, it must usually be supplemented for general surgery by alkaloidal narcosis or light ether anesthesia or both. Morphin with atropin or hyoscin is the recognized alkaloidal adjuvant. Without these adjuvants it is impossible to hold in surgical anesthesia robust, athletic individuals, and those of alcoholic, tobacco, and other narcotic habits without dangerous degrees of asphyxia.

ALKALOIDAL NARCOSIS SUPPLEMENTAL TO NITROUS-OXID.

Preliminary alkaloidal narcosis renders the course of nitrous-oxid anesthesia smoother, increases the depth of anesthesia, allows an increase of 1 to 3 per cent. in the oxygen percentage, and renders the necessity for ether less frequent. However, these narcotics desensitize the respiratory center and increase the danger of respiratory collapse

from asphyxia. Scopolamin or hyoscin also occasionally exercise rapid, powerful depression on the circulatory mechanism. Indeed, I can name a dozen surgical and medical associates who, working amid the human derelicts of the large New York hospitals, have seen this drug in their individual experiences, administered in recognized therapeutic dose, kill like the blow of a slaughter-house sledge.

ETHER ANESTHESIA SUPPLEMENTAL TO NITROUS-OXID.

By proper combination of ether with nitrous-oxid the best points of both of these anesthetics may be secured. By combining the very light or the subconscious zone of nitrous-oxid anesthesia, 11 to 14 or 14-16 per cent. of oxygen, with the light subconscious zone of ether anesthesia, a vapor pressure of 15 to 25 millimeters, a physiologically ideal state of general anesthesia may be induced, for the light transitory anesthesia of nitrous-oxid is secured, together with the relaxation, sensory nerve-end paralysis and post operative analgesia of ether. The asphyxial zones of nitrous-oxid may be avoided on the one hand, while on the other there is no such concentration of ether vapor as actively stimulates mucous secretion in the bronchi, the dosage remaining well below the disassociation level of the vomiting center, present at about 25 m.m. of ether tension, nor do the after effects exceed those of unsupplemented nitrous-oxid administration.

TECHNIC *1: Supplemental Narcosis by ether when required.* At any time during the course of nitrous-oxid oxygen anesthesia, when it becomes necessary to secure more efficient anesthesia or to establish relaxation, the administration of ether is desirable. This is a far safer procedure than to persist in attempting to subdue the patient by unsupplemented nitrous-oxid anesthesia, by reducing the oxygen supply.

About 86 millimeters of ether vapor pressure, 65 drops of ether per gallon of gas, is necessary to establish an efficient state of anesthesia within reasonable time, from 3 to 5 minutes. When relaxation is secured, the ether is discontinued or reduced to minimal dosage, 20 m.m. of vapor pressure or 15 drops of ether per gallon of gas.

TECHNIC *2: Routine Relaxation by Ether Vapor.* The patient is primarily anesthetized by nitrous-oxid oxygen. Ether is now slowly added increasing the vapor pressure to about 86 millimeters by adding about 65 average size drops of ether for each gallon of gas, usually two drops per second. At the same time the oxygen percentage may be increased to 12 per cent. When anesthesia is complete and general relaxation has been established, usually within 6 minutes, the anesthetic state may be readily continued by nitrous-oxid oxygen alone, usually without further recourse to ether.

TECHNIC *3: Routine Relaxation by Oil-Ether administered by Rectum.* The method of Gwathmey would seem one of great future promise, namely, very light preliminary ether narcosis by rectal administration of small dose of a weak oil-ether mixture. To obtain the desirable mental confusion or subconsciousness and the analgesia and relaxation of the light subconscious zone of ether anesthesia, 15 to 25 m.m. of ether tension; probably a mixture of ether 50 per cent. in oil, half an ounce to each 20 pounds of body weight will suffice administered by the Gwathmey rectal method, ½ hour before operation.

TECHNIC *4: Routine Combination of Ether Nitrous-Oxid Anesthesia. The Best Method.* By starting the administration of ether immediately in nitrous-oxid administration, adding less than 22 drops of ether per gallon of gas, the dosage of ether vapor may be kept constantly below 30 millimeters of ether vapor pressure. The oxygen content in the tidal gas may be gradually increased to 15 per cent. Thus the safest, most satisfactory state resultant from any general anesthetic is obtained; a state combining the light subconscious zone of both ether and nitrous-oxid into one of deeper yet controllable anesthesia. A proper ether flow is a drop every two seconds for the first half hour; thereafter a drop every three seconds. The gases are best delivered continuously, 9 to 10 litres per minute. Thirty grams of ether per hour and 150 gallons of gases should be used.

SUMMARY AND CONCLUSIONS.

1. The effect of a given nitrous-oxid-oxygen mixture is constant on normal man.

2. The anesthetic effect is in a degree inversely as the proportion of oxygen.

3. The ultimate gas tension which the drug establishes is not at present an available gauge of dosage.

4. The only available gauge of qualitative dosage is the proportion of oxygen with which the drug is administered.

5. The action may be differentiated into consecutive levels or zones of anesthesia, according to the average amount of oxygen present in the tidal gases. For analgesia in normal man the proportion of oxygen in the tidal gases of breathing may exceed 20 per cent. Below this the consciousness becomes gradually abolished until at 16 per cent. the patient slowly becomes unconscious. From 14

to 11 per cent. there is sufficient anesthesia for surface operations; from 11 to 8 per cent. there is sufficient anesthesia for abdominal surgery, associated, however, with slight asphyxia and without proper muscular relaxation. Below 8 per cent. the mixtures are useful only for induction of anesthesia, and below 6 per cent. they become so highly asphyxial that they should not be used even for tooth extraction.

6. Higher percentage of oxygen is required when the tidal volume is below the average, or the oxygen-carrying capacity of the blood is diminished.

7. At least 6 litres of fresh gases per minute are required for smooth anesthesia and to establish normal excretion of carbon dioxid and other gaseous waste products; preferably 8 to 10 litres per minute of a uniform mixture is supplied in a continuous flow.

8. By continuous flow and known dosage with accurate and constant measurement and control the level of each patient may rapidly be found, and after the first 15 or 30 minutes anesthesia may run continuously without further adjustment.

9. Unsupplemented nitrous-oxid-oxygen anesthesia is ineffective to block the centripetal stimuli of operative trauma.

10. Nitrous-oxid-oxygen anesthesia is most advantageously supplemented by ether.

11. Light ether anesthesia, the light subconscious zone of ether, a tension of 15 to 25 m.m. in conjunction with the subconscious or light subconscious zones of nitrous-oxid-oxygen anesthesia, 14-16 or 16-20 per cent. of oxygen is physiologically the most advantageous of all anesthetic states.

12. Owing to present complexity and inaccuracy of administration, the average nitrous-oxid anesthesia, even when effectively supplemented, possesses no practical advantage over properly induced and well-maintained ether anesthesia.

ROOSEVELT HOSPITAL.

FEATURES IN THE APRIL SUPPLEMENT

RESUSCITATION IN THREATENED FATALITIES DURING GENERAL ANESTHESIA.
E. H. EMBLEY, M.D., M.R.C.P.,
Melbourne, Australia.

KIDNEY FUNCTION IN ITS RELATIONS TO GENERAL ANESTHESIA.
JAMES J. HOGAN, M.D., M.R.C.P.,
San Francisco, Cal.

PROCEEDINGS OF THE SCOTTISH SOCIETY OF ANESTHETISTS.

THE ADVANTAGES OF COMBINED ANESTHESIA IN THE OPERATIVE TREATMENT OF HEMORRHOIDS.*

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Routine operative methods that have been devised for the treatment of external and internal hemorrhoids under local or general anesthesia are invariably followed by post-operative pain and discomfort entirely out of proportion to the gravity of the condition.

To operate under local anesthesia in rectal cases is usually a tedious procedure, and in a majority of the cases is accompanied by severe pain. Under general anesthesia graver difficulties are experienced, especially during dilation of the sphincter.

A large number of sufferers with hemorrhoids refuse operation, not on account of the length of time necessary for a cure, but because of the severe pain and discomfort that persist for several days after the operation.

It is the object of this paper to outline a method that not only eliminates post-operative pain, but also accomplishes relaxation of the sphincter *without manual dilatation*. It excludes all difficulties in the administration of the general anesthetic; the patient's color remains good and the breathing regular throughout the entire operation.

NERVE SUPPLY OF THE ANAL REGION.

In order to better understand the method used in accomplishing the foregoing results, a brief review of the nerve supply of the anal region is necessary.

The nerves supplying the anus are derived from both the cerebro-spinal and the sympathetic nervous systems. Those originating from the former come from the fourth sacral nerve, and those from the latter from the hypogastric plexus. The muscles of the anal region are supplied by branches of the sacral nerves, while the superficial perineal branch of the internal pudic supplies the levator ani and skin in front of the anus, and the inferior hemorrhoidal branch inervates the lower end of the rectum and anus.

It can readily be seen that since the anus is supplied by the fourth sacral nerve and the branches of the internal pudic, severe local pain and wide distribution of reflex pain will be experienced as the result of operative trauma. Because of the close nervous association between the anus and the outlet of the bladder, we note, on the one

*From the surgical service of Dr. Chas. Goodman.

hand, the frequent desire to urinate as a result of anal irritation and, on the other hand, temporary retention of urine due to the vesical spasm that follows trauma to the anus.

DIFFICULTIES UNDER ANESTHESIA.

In the usual operations for hemorrhoids under general anesthesia, we have all seen how difficult it is to keep the patient fully relaxed and in a safe plane of surgical narcosis. As soon as dilatation of the sphincter is begun, the patient becomes cyanosed and the breathing stertorous. Not infrequently at this time we witness struggling of the patient on the table, due to reflex cerebral stimulation.

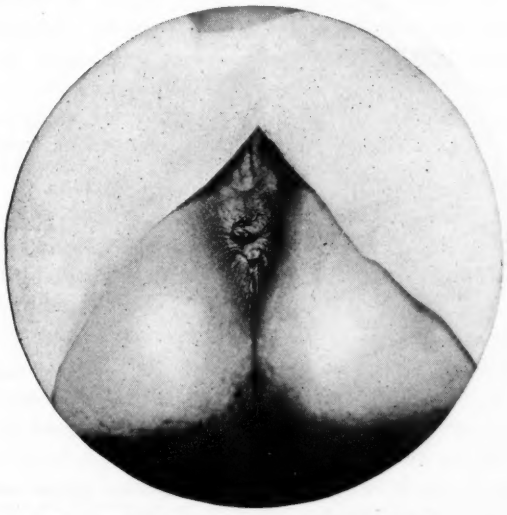

Fig. 1.—Case 13. Showing anus before injection.

Dilatation of the sphincter is often completed too rapidly, and as a result of this unnecessarily rough manipulation the mucous membrane is torn and very frequently a hematoma is produced in the rectal wall. Tears in the mucous membrane may become the focus of infection, or give rise to fissures. Hematomas, ultimately, may cause ulceration of the rectal mucous membrane by pressure, with continual bleeding or late secondary hemorrhage.

The excruciating post-operative pain usually persists for 24 to 72 hours. Temporary retention of urine almost always occurs, so that catheterization, with its attendant dangers, becomes necessary.

Realizing that the anal region has been endowed with a large nerve supply, it occurred to me that if I could obtain complete relaxation of the sphincter without manual dilatation and block off the nerve impulses during the operative procedure, then the manipulation would have no effect upon the course of the anesthesia, nor would the patient be subjected to the markedly severe pain and discomfort that always follow operations for hemorrhoids. With these objects in view I have utilized the principles of Crile's method of anoci-association anesthesia.

THE NEW METHOD OF COMBINED ANESTHESIA.

The method that has been practiced in a series of 16 cases is as follows: The preparation of the patient is the usual method of thoroughly evacuating the bowels. Three-quarters to one hour before the induction of general anesthesia, a hypodermatic injection of morphine sulphate 1/6 of a grain and atropine sulphate 1/150 of a grain is given. Ether by the open drop method is the anesthetic used. The patient is never placed in the lithotomy position until well under the effects of the narcotic. The skin area about the anus is painted with a three and a half per cent. solution of tincture of iodine. Four points are selected about the circumference of the anus, one-half to three-fourths of an inch from the muco-cutaneous junction, corresponding to 12, 3, 6 and 9 on the dial of a clock. A solution containing two parts of a one-half per cent. solution of novocain and one part of a 1/600 solution of quinine and urea hydrochloride is injected into the internal sphincter of the anus at each point. The course of the needle is guided with a finger in the rectum, so that one may be absolutely certain that the needle is in the sphincter and not in the lumen of the bowel.

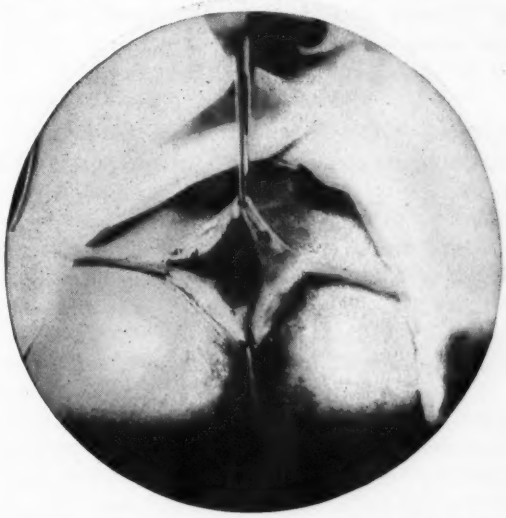

Fig. 2.—Case 13. Showing the amount of relaxation of the anal opening after the injection of novocain and quinine and urea hydrochloride. Allison forceps in position.

Almost immediately after the solution is injected the guiding finger feels the sphincter relax. After waiting a minute or two it is possible to insert the breadth of four fingers into the anal opening without any resistance whatever. Also there is no reflex contraction of the sphincter. The hemorrhoids are very readily rolled into view, by placing four Allison forceps at opposite points at the mucocutaneous junction, as seen in Figures 2 and 4. The hemorrhoids are thus easily exposed and whatever method is selected for their removal can be practiced without any difficulty. I have used the clamp and cautery method without putting either a tube or packing into the rectum. The average amount of novocain and quinine and urea hydrochloride solution used was 15 to 20 c. cm. for each case. The patients maintain a good color and breathe quietly throughout the operation. The amount of ether used in each case has been one-third to one-half the amount necessary under general anesthesia alone. In a number of the cases we have discontinued giving the anesthetic fifteen to twenty minutes before completion of the operation. On recovery from the effects of the anesthetic fifty per cent. of the patients have been entirely free from post-operative pain, according to our charted results. The remaining number have required but one dose of an hypnotic throughout the entire post-operative period.

PROLONGED OBTRUDING EFFECT OF QUININE AND UREA.

I attribute the prolonged relaxation of the sphincter and the absence of the post-operative pain to the continued anesthetic effect of the quinine and urea hydrochloride, and furthermore, I feel assured it is this agent that blocks the impulses that cause reflex spasm of the neck of the bladder. In our entire series of cases all patients have voluntarily urinated, showing that the method eliminates the danger of infection of the bladder by catheterization.

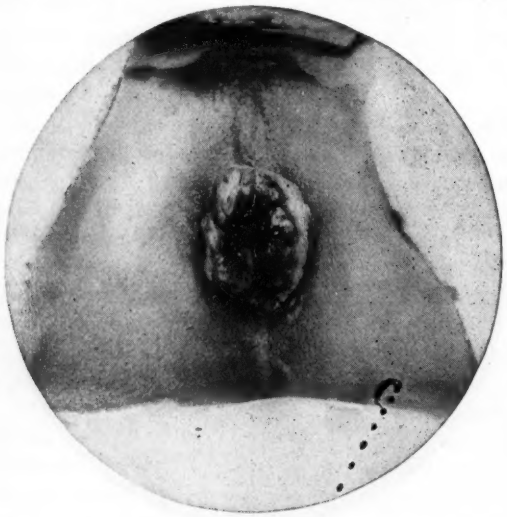

Fig. 3.—Case 16. Shows anus and hemorrhoids before injection.

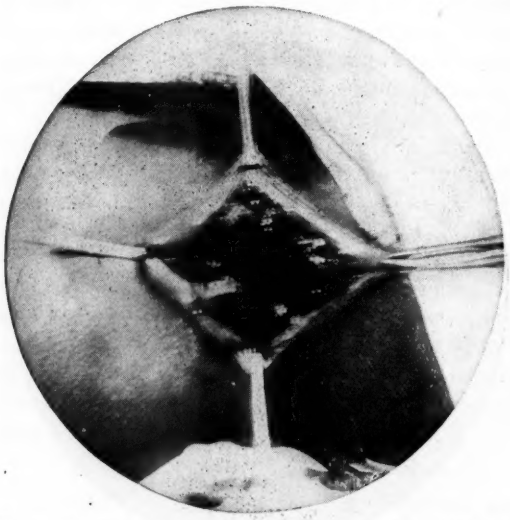

Fig. 4.—Case 16. Shows relaxation of the anal opening, and hemorrhoids brought into view, after the injection of the novocain and quinine and urea hydrochloride.

Chart: Combined Anesthesia in the Operative Treatment of Hemorrhoids.

Case No.	Discharge Number	Date of Admission	Date of Operation	Date of Discharge	Internal or External Piles	Hypnotic Given	Catheterized
1	1187	3/31/14	4/3/14	4/10/14	int.	none	no
2	1223	4/10/14	4/11/14	4/16/14	ext.	none	no
3	1246	4/13/14	4/15/14	4/19/14	int.	none	no
4	1264	4/13/14	4/15/14	4/22/14	both	once	no
5	1358	5/1/14	5/2/14	5/8/14	int.	once	no
6	1418	5/10/14	5/11/14	5/16/14	int.	once	no
7	1490	5/17/14	5/18/14	5/25/14	both	none	no
8	1535	5/18/14	5/20/14	6/1/14	int. anemia	none	no
9	1538	5/26/14	5/27/14	6/1/14	int.	once	no
10	1614	6/3/14	6/3/14	6/10/14	both	once	no
11	1629	6/2/14	6/3/14	6/12/14	int.	once	no
12	1832	7/6/14	7/7/14	7/9/14	both	none	no
13	1847	7/13/14	7/15/14	7/25/14	int.	none	no
14	1864	7/6/14	7/7/14	7/14/14	both	once	no
15	1878	7/7/14	7/8/14	7/17/14	both	once	no
16	1962	7/24/14	7/25/14	7/28/14	ext.	none	no

For purposes of comparison, I have operated on four cases for hemorrhoids under purely local analgesia, using the solution of two parts of a one-half per cent. novocain and one part of the 1/600 quinine and urea hydrochloride, and injecting this solution into the sphincter ani in the same manner as with the method of combined anesthesia. Although perfect relaxation of the sphincter is obtained, and the cautery causes no pain, it is nevertheless a very tedious procedure to keep entirely within the bounds of the analgeric area. The injection into the sphincter renders the skin area analgesic only for a short distance around the mucocutaneous junction of the anus. The pain from the insertion of the needle into the sphincter is severe in itself. Only two of these four cases urinated voluntarily, and all received more than one hypodermatic injection of morphine. With combined anesthesia we have entirely eliminated the necessity for catheterization in every case, and when an hypnotic was necessary one dose sufficed.

ADVANTAGES OF THE COMBINED METHOD.

The disadvantages of both local analgesia or general anesthesia are entirely overcome by the combined method. The advantages of this method may be summed up as follows:

1. *Anesthesia.* Profound anesthesia is not necessary to secure the proper relaxation of the sphincter. Untoward symptoms such as cyanosis and stertorous breathing are entirely eliminated. The amount of general anesthetic used is reduced from one-half to one-third that required under general anesthesia alone, and therefore post-anesthetic general sequelae are reduced to a minimum.

2. *Exposure of Hemorrhoids.* The ease with which the hemorrhoids are brought into the field of operation eliminates unnecessary manipulative trauma, and its direct and indirect complications.

3. *Post-operative Pain.* Fifty per cent. of the patients are without pain after the operation; while the pain in others is reduced, so that but one dose of an hypnotic is necessary to carry them through the entire post-operative period.

4. *Post-operative Catheterization.* Since catheterization, even under the strictest aseptic precautions, is attended with the dangers of trauma to the urethra, infection of the bladder and even ascending infection of the urinary tract, the removal of this danger alone establishes the great value of the combined method of anesthesia in the operative treatment for hemorrhoids.

1945 SEVENTH AVE.

TREATMENT OF POST-OPERATIVE SHOCK.*

BY PROF. CHARLES LIEB,
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The successful prevention and treatment of shock depend upon an accurate conception of its nature and causation. Numerous theories have been offered to explain the phenomena of shock, but when put to the clinical test they have all proved disappointing. Thus, the vasomotor center is not exhausted; the heart is not primarily involved; acapnia is not necessarily present; oligemia is not usually demonstrable; over-inhalation has not been proved; adrenal insufficiency is not generaly admitted; the disappearance of the Nissl bodies from the cells of the cerebellum and the region of the fourth ventricle is not constant.

Despite the painstaking and brilliant investigations which have been made in the attempt to solve the problem, we know little or nothing about the nature of shock. We have learned, however, the direct exciting cause of shock. In the last analysis, shock is always due to afferent impulses—impulses which may arise at the periphery or within the central nervous system itself. It is upon this scant foundation that the treatment of shock must be built.

The prophylatic treatment has been so carefuly perfected by Crile and has proved so successful when properly carried out, that it need not detain us. The one essential is the prevention of the development, or at least of the transmission, of noci impulses.

The treatment after shock has once developed is governed by the same principles. The wound or injury should be physiologically isolated from the central nervous system by means of cocaine, novocaine, or urea-quinine hydrochloride, and mental anxiety allayed by the use of morphine. The importance of thus staying the further progress of shock cannot be overemphasized.

The relation between afferent impulses and shock is so firmly established that no plan of treatment is worthy of consideration that does not include protection of the central nervous system from incoming stimuli. The further treatment of shock is more difficult, more unsatisfactory, more perplexing. The symptoms are familiar, but nothing is known of the pathological changes of which these symptoms are the clinical expression. We can

*Read during the Second Meeting of the American Association of Anesthetists, at Atlantic City, June 22, 1914.

treat the symptoms, but the utter uselessness of such therapy is only too often apparent.

Because the circulation is easily studied, undue prominence has been given to pulse rate and blood pressure. It is generally admitted, however, that neither the blood itself, nor the heart, nor the vasomotor center is the primary cause of shock. Indeed, the patient may be in profound shock and yet heart rate and blood pressure may be normal. Nevertheless, treatment, as ordinarily carried out, consists essentially of circulatory stimulation.

Since the treatment of shock is purely symptomatic, the measures employed should be at least harmless; that is, they should neither aggravate the symptoms nor intensify the degree of shock. This is the test to which the therapy of shock must be submitted. All measures that fail to meet this standard are certainly contraindicated.

The reflex stimulants form the first group of drugs to which I wish to call your attention. The group includes the "reflex stimulants" in the narrower sense, as well as alcohol, ether, and the numerous proprietary preparations which have alcohol or glycerine as solvents. Before absorption, any effect which they roduce is of reflex origin. By their direct irritation of the nerve endings, with which they come into contact, they initiate a stream of centrifugal impulses; these reaching the central nervous system, produce changes identical with those arising in a wound or injury. Qualitatively, these impulses are as shock-producing as any other afferent impulses.

Camphor should also be included in this group. It, too, is a local irritant, and the effects which follow its injection are partly reflex and partly central in their origin. The stimulation of the central nervous system is subordinate to the local action, and camphor is as much contradindicated as any other irritating drug.

Not only are all shock-producing drugs contraindicated, but that group which facilitates the transmission of impulses within the central nervous system must also be avoided.

So much has been written about the danger of using strychnine in the treatment of shock that it is not necessary for me to condemn it further. I wish, however, to remind you of the way in which strychnine acts upon the central nervous system. It opens new paths along which the afferent impulse may travel freely up and down the cord, affecting an abnormally large number of cells. The response to a given stimulus is therefore stronger and more widespread than normal. A subminimal impulse becomes effective. In other words, it may be said that strychnine increases the force of each afferent stimulus by raising the shock-value of the impulse and by lowering the shock resistance of the individual.

Caffeine, however, is said to have a proper place in the therapeutics of shock. When it is remembered that caffeine has the same effect upon the cord as strychnine, its position immediately becomes untenable. Stimulation of the psychic areas, an important function of caffeine, tends to arouse the patient and to add psychic shock to the existing surgical shock. It may be claimed that the circulatory stimulation outweighs the disadvantage consequent on stimulation of the central nervous system. Caffeine, however, has not proved a powerful circulatory stimulant, and no marked benefit can be expected from its administration. Large doses possess all the disadvantages of strychnine and probably exert, in addition, a depressant action upon the heart.

The use of hot black coffee in the form of an enema is so frequently recommended that an analysis of its action may prove of value. The effect is due partly to the caffeine; more important are the empyreumatic oils, the pint of water, and the heat. Any action of the aromatic oils will be the result of a reflex, a method of treatment that has already been condemned. The hot fluid, which is the only advantage possessed by coffee over strychnine, can be administer to much better purpose in the form of a hot saline irrigation.

In discussing the drugs which act directly upon the circulation, we may consider first those which lower blood pressure. These may be divided into the cardiac depressants and the arterial dilators.

Aconite and veratrum viride are the most important members of the first group. They lower blood pressure by slowing and depressing the heart. If shock were due to acceleration of the heart—as has been claimed—these drugs would be indicated, despite the fall in blood pressure which they produce. The acceleration of the heart, however, is the manifestation of the attempt on the part of the heart to maintain an efficient circulation, and any slowing thereof is reflected in a slowing of the circulation—a reaction which is most certainly undesirable.

The nitrites lower blood pressure by dilating the blood vessels. The most serious symptom of shock, from a prognostic point of view, is a low blood pressure, and any attempt to lower that blood pressure further regularly results in deepening the degree of shock. We conclude, then, that no drugs that lower pressure are called for.

Of the drugs which raise blood pressure, epi-

nephrin, pituitrin, and possibly strophanthin, are the most important. The subcutaneous or intravenous injection of atropine is frequently followed by a rise in blood pressure, the extent of which varies directly with the tonus of the vagal center. Only when the tonus is such that the heart is beating slowly does atropine produce a considerable rise in blood pressure. The rise is secondary to the augmented output of the accelerated heart and not to vasomotor stimulation. In shock, vagal tonus is slight or absent. The heart has escaped from vagus control, and one neither expects nor finds a rise in pressure after atropine.

Clinically, epinephrin has proved to be the most efficient drug in combating the low blood pressure of shock. The method of administration is extremely important. Neither subcutaneous or intramuscular injection is followed by the slightest rise in pressure. Only when the drug is injected directly into a vein are the vessels constricted.

The injection of a few minims of epinephrin is followed by a very small, evanscent rise in pressure. In order to obtain a more marked and more prolonged effect, the drug must be given in conjunction with a saline infusion. The rise in blood pressure outlasts the infusion but a very few minutes. It is necessary, therefore, to be sparing both of the saline and of the epinehprin. The free use of the salt solution soon leads to hydremic plethora and the heart becomes embarrassed. If too much epinephrin is employed, the rise in blood pressure becomes excessive and the work of the heart is unnecesharily increased. Accordingly, the epinephrin-saline infusion is continued until blood pressure is approximately normal. The infusion is then interrupted, to be resumed when the blood pressure falls dangerously low.

In the laborataory, at least, pituitary extract has a distinct advantage over epinephrin. The rise in blood pressure which follows its intravenous injection is maintained for hours rather than minutes. Like epinephrin, the subcutaneous or intramuscular injection of pituitrin is not followed by any improvement in the circulation. This effect is produced only when the drug is given intravenously, and may be increased by the simultaneous administration of a saline infusion. The side effects on urinary secretion and on the intestine are independent of the effect on blood pressure.

Clinically, the drug has proved somewhat disappointing and is not employed so frequently as a few years ago.

The digitalis preparations when administered by mouth affect the circulation only after the elapse of from twenty-four to forty-eight hours. This prolonged latent period precludes their oral administration in the treatment of shock.

None of the official or proprietary preparations is fit for intravenous injection. Hence, if a digitalis effect is desired, strophanthin should be employed. Administered in doses of not more than 1 mg. in twenty-four hours it produces within half an hour a considerable slowing and strengthening of the heart and a rise in blood pressure. This effect frequently persists for eighteen hours. The value of this drug as a circulatory stimulant has not been recognized by the surgeon.

Of the mechanical means of raising blood pressure, gravity is of the utmost importance. The head-down position assures a fair blood supply to the higher divisions of the central nervous system and materially assists the return of the blood to the right heart. The same advantages may be obtained by the use of pressure, particularly when applied to the limbs and abdomen.

The quantity of fluid within the blood vessels can be increased, temporarily at least, by a saline infusion. A far better method is to transfuse, because the rise in pressure is much longer maintained.

The betterment of the circulation which follows any of these procedure leads to improved nutrition of the central nervous system and all the other organs, and frequently assists in the recovery of the patient. Again I wish to emphasize that circulatory failure is only one of the symptoms of shock and is rarely the direct cause of death. Probably 90 per cent. of the cases die from respiratory paralysis.

Whether the respiratory failure is due to the asphyxia secondary to the low blood pressure, or whether it is due to the absence of the normal hormone, has not been determined. It is necessary, therefore, to maintain a fairly efficient circulation and to conserve or administer carbon dioxide during shock.

What drugs may be used to stimulate the respiratory center?

Measured by the standard already set, drug stimulation of the respiratory center is limited. It has already been shown that neither reflex stimulation nor caffeine nor strychnine may be employed. Atropine is probably the only drug which may be used. I venture to suggest that even this drug is contraindicated because further investigation will probably prove that its action on the central nervous system resembles closely that of strychnine or caffeine.

Surgical shock may be complicated by:

(1) Hemorrhage. The only modification of the treatment necessary is prompt restoration of the fluid lost, either by saline infusion or by a transfusion.

(2) Toxemia, particularly that caused by the anesthetic. Chloroform is a powerful ciculatory depressant and renders the patient more susceptible to surgical, traumatic, and hemorrhage shock.

There are two forms of chloroform death, depending upon the strength of the vapor inhaled. Concentrated mixtures of chloroform and air paralyze the heart and kill the patient before anesthesia is established. In these cases respiration continues after the heart has stopped.

Very dilute solutions of chloroform and air cause a progressive lowering of blood pressure and weakening of the heart from the moment their inhalation is begun. When death occurs under these conditions it is due to respiratory failure; the heart continuing to beat after breathing has ceased.

The first type of chloroform poisoning may be prevented by avoiding the use of a too concentrated anesthetic mixture. If the heart has stopped, artificial respiration should be at once instituted. The Sylvester method has the advantage that during the compression of the chest the heart is massaged and the chloroform-laden blood is expelled from its chambers.

Chemical stimulation of the heart is absolutely necessary. The surest method of bringing a drug into direct contact with the cardiac muscle is by perfusing it through the coronary arteries. Accordingly, an artery is exposed and a cannula is inserted pointing towards the heart. The saline infusion is then begun, and epinephrin is injected through the rubber tubing just above its connection with the arterial cannula. The epinephrin-saline infusion is thus passed through the coronary arteries; the closed aortic valves preventing its entrance into the cavity of the left ventricle. This method of cardiac resuscitation is successful in about 30 per cent. of the cases. The chief difficulty is in estimating the quantity of epinephrin that is to be used. If too much is injected, it causes a powerful constriction of the blood vessels and a tremendous rise in blood pressure. The heart, already weakened by the chloroform, contracts once or twice against this enormous resistance, then passes into fibrillation and permanent death.

When chloroform causes respiratory failure, artificial respiration is usually sufficient to revive completely the patient. If necessary, an intravenous injection of epinephrin may be employed to support the heart.

Ether rarely causes circulatory depression. Death after ether is always due to paralysis of the respiratory center, and should never be permanent. The heart continues to beat after breathing has stopped and its death is due to asphyxiation. Artificial respiration and an intra-arterial infusion, such as was described under chloroform, will almost invariably revive such a heart.

SUMMARY.

The treatment of shock as usually carried out is empiric. A rational treatment must be established. It must be based upon what has actually been learned about the causes and nature of shock. Shock is directly due to afferent impulses. The rational treatment of shock must therefore be directed against the exciting cause. The rest of the treatment is purely symptomatic. It must not increase, directly or indirectly, the susceptibility to shock.

The rational treatment of shock comprises: Protection of the central nervous system from afferent impulses, by (a) physiological isolation of the wound; (b) allaying mental anxiety by means of morphine.

This shielding of the central nervous system, together with the head-down position and the application of external heat, constitutes the nucleus, if not the whole rational therpay, of shock. It assists nature by working with her, and interpsoses no obstacle to recovery. If applied early this treatment will prevent the development of shock; if carried out after shock is present, it will assist in the recovery. A transfusion is unquestionably the most promising method for supporting the circulation. If a donor is not at hand, an epinephrin-saline infusion may be given. Since neither of these measures attacks the exciting cause of shock, too much cannot be expected of them.

Carbon dioxide should be administered in the presence of a definite history of hyperpnoea.

Under no circumstances are reflex stimulants to be employed. Caffeine, strychnine, cardiac depressants, and the nitrites are absolutely contraindicated.

There is, I believe, a real danger in overdoing stimulation, so that we retard rather than assist the recovery of the patient. The only completely successful treatment of post-operative shock may be summed up in the word—*prophylaxis.*

COLUMBIA UNIVERSITY.

FRACTIONAL REBREATHING IN ANESTHESIA—ITS PHYSIOLOGIC BASIS, TECHNIC AND CONCLUSIONS.

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In a preliminary report attention was called to this method in 1911. Since that time I have used the method continuously, and all cases have been charted as to the amount of rebreathing, the systolic and diastolic blood pressures, pulse rate, respiration rate and volume, the percentages of gas and oxygen used, and the quantity of ether used, when the latter has been employed as a supplemental anesthetic. These determinations have been made prior to anesthetization in each case, and at five to ten-minute intervals, or oftener, in some cases, throughout the entire period of anesthesia.

HISTORICAL CONSIDERATIIONS.

Since Priestly discovered nitrous oxid in 1772, it has been used to produce peculiar sensations and strange mental effects. For years after its discovery this property made it a popular means of entertainment quite similar to present day exhibitions of hypnotism. During these exhibitions on many occasions people fell and painlessly sustained injuries. As early as 1800 Sir Humphrey Davy suggested its use in surgery, but nothing was done clinically to clinch his opinion.

Henry Hill Hickman, of Ludlow, Shropshire, England, between 1820-28, set about to discover some means of relieving pain during his operations. Experimenting on animals, he first produced semi-asphyxia by excluding air (by rebreathing CO_2), and later by using N_2O with success. He was not able to interest his profession at home or in Paris, however, and died in 1829 without applying his discovery to the human subject.

Horace Wells, a dentist of Hartford, Conn., in July or August of 1840, in a conversation with Linus Brockett, M.D., said: "I believe a man may be made so drunk by this gas (nitrous oxid) or some similar agent, that dental or other operations may be performed upon him without any sensation of pain." Wells was already thinking about anesthesia, and when Prof. C. Q. Colton four years later gave an exhibition with nitrous oxid in Hartford on the evening of December 10, 1844, the occurrence of another accident, in which one of the subjects was painlessly injured, further substantiated the opinion of Wells, who was one of the spectators at the exhibition and had also taken the gas. The next morning Wells conversed with Prof. Colton upon the subject of painless injuries, of the possibilities of nitrous oxid in dentistry, and suggested that Prof. Colton come to his office and administer nitrous oxid to him while he had an upper third molar extracted under its influence.

Accordingly the appointment was made. Dr. John M. Riggs was called to do the extraction, and quoting Dr. Riggs' own words: "Dr. Wells, after seating himself in the operating chair, took the bag and inhaled the gas, he threw back his head and I extracted the tooth. It was a large molar in the upper jaw, such as is sometimes called a 'wisdom tooth.' It required great force to extract it. Dr. Wells did not manifest any sensibility to pain. He remained under the influence of the gas for some time after, and immediately upon recovering from it he swung his arms and exclaimed: 'A new era in tooth pulling.' He remarked that he did not feel any pain from the operation."

Wells was so certain of the nature of his discovery and fearless in its application that he, Dr. Riggs and other dentists at once began using nitrous oxid in their practices, and even went so far as to set apart a day when teeth would be extracted without pain.

In an endeavor to bring his discovery of anesthesia to the notice of the medical profession at large, he went to Boston and gave a public demonstration on *one* patient. The result was unsatisfactory because the gas bag was removed before the patient was thoroughly under. "The patient howled somewhat during the operation, but on his return to consciousness, said he felt no pain whatever." Wells, however, was denounced as an impostor, although during this stay at Boston he successfully anesthetized a group of medical students for their own instruction.

The one case, usually referred to as a failure, especially by those who, a few years later, tried to rob Wells of the honor of having discovered anesthesia, was not in reality a failure, nor did it retard the use of gas, which was soon employed in many places for operations of various kinds.

It is noteworthy that Wells' apparatus consisted of only a large bag and a mouth tube to breathe through. The patient rested the bag of gas in his lap, took the tube into his mouth, and inhaled the gas while the nose was held with one hand. It is obvious, therefore, that the first application of gas as an anesthetic was by the rebreathing method since there were no check valves to prevent it.

Wells had considered ether as an anesthetic, but on account of its odor and the nausea it produced, which were well known from the "ether frolics," common in those days as a means of entertainment,

he preferred nitrous oxid, which in his opinion was more like air and safer.

William T. G. Morton, who had been a student of Wells, and for a short time also a partner in his office, 1846, or nearly two years after Wells' discovery, publicly demonstrated ether, and later attempted to appropriate the honor of having discovered anesthesia. Morton first sprinkled the ether on a handkerchief, but later it was placed in a flask having two openings to breathe through; one opening was placed to the patient's mouth by means of a tube, and the patient inhaled to and fro through the flask, picking up the ether vapor. In this way rebreathing was also early established in the administration of ether. But this apparatus had to be improved because of the inadequate supply, or concentration of ether vapor for some cases, especially the heavy breathers.

Next came the type of apparatus which was devised by Clover and variously modified and imitated by a host of others. It consisted essentially of Morton's flask, with the additional means of controlling the amount of air coming into contact with the ether, and also a bag to increase the rebreathing. This bag was the principal improvement, since it retarded the elimination of ether from the blood, thereby making etherization easier. This is known as the "closed method," while Morton's flask was a "semi-closed method," since the amount of rebreathing in the latter was partial and always constant, and depended upon the dead space in the flask and upper air passages.

The Clover method was used for years, but finally fell into disuse with most American surgeons, because of incompetent administrators. This simple but inaccurate apparatus required a high degree of skill for its proper management; as a result, patients were often allowed to breathe to and fro from the bag until they were quite asphyxiated and overcharged with ether and CO_2 before fresh air was administered.

Although many have held to the closed method, the so-called open method has largely displaced it in this country. The latter, in reality, is not open, but semi-open, since air is *not freely* accessible through the many layers of gauze or toweling ordinarily used. With some "open" masks and the usual amount of gauze, rebreathing is excessive, since 200 to 400 c.c. of *alevolar* gases are thus retained and rebreathed; a study of the symptoms alone shows it.

With ether we have had three eras. The first two have purposely employed rebreathing; the third, the open-method era unintentionally employed considerable rebreathing; and it now appears that the fourth is beginning. The coming era will give us accuracy in dosage of ether vapor, accurate rebreathing, the return of apparatus for its administration, and more restrictions in its use.

When Wells chose nitrous oxid in preference to ether as his anesthetic agent he did not know that he had selected an agent which, to this day, remains the most difficult to administer; an agent requiring the most accurate mechanical control of the gases to produce uniformly good results. It was this fact which gave ether, and later chloroform, their opportunity to practically supplant N_2O in general surgery, and this retarded for years the perfecting details that we now recognize as imperative in perfect N_2O-O anesthesia. The professional anesthetist now taking his place in the operating room is mastering N_2O-O anesthesia and bringing it into general use.

In the '90s there was some discussion tending to show that rebreathing exhaled gases, especially CO_2, was liable to poison the patient, when a considerable proportion of gas users adopted the valved inhalers which would not permit rebreathing. During the same period chloroform had gained supremacy over "closed ether," being administered by the open method—a fact which also may have influenced the two professions against rebreathing in nitrous oxid.

We must not pass the year 1868 without at least mentioning the fact that Andrews of Chicago demonstrated the value of oxygen with N_2O, the application of which, by others, has made major surgery uniformly practicable with N_2O anesthesia.

The first successful attempt to administer nitrous oxid and oxygen at ordinary atmospheric pressure by means of an apparatus capable of regulating the proportions of the two gases was made by Hillischer, of Vienna, and it was the report of his investigation that attracted Hewitt's attention to the subject. In 1886 this master administrator commenced a series of experimental administrations at the Dental Hospital in London, giving impartial attention to all known methods of nitrous oxid anesthesia, using it alone, concurrently with air, or in combination with oxygen, in varying percentages, and finally with *rebreathing of the gases.* These clinical researches resulted in the development of the Hewitt apparatus, which for years was the most efficient device obtainable for nitrous oxid oxygen anesthesia. At this time Hewitt succeeded in maintaining a non-asphyxial type of nitrous oxid-oxygen narcosis for periods of 35 minutes, for such operations as Syme's amputation, lithotrity, re-

moval of the breast, excision of varicose veins, varicocele, resection of the patella, several intra-uterine operations, and numerous minor surgical operations and the *dressing of wounds and readjustment of splints.*

The first systematic endeavor to administer nitrous oxid and air for prolonged anesthesia was made by Bush, of Brooklyn, who employed an apparatus with a sliding valve, so arranged as to admit atmospheric air according to the requirements of the patient and the narcosis. Operations lasting upward of one hour were performed under the influence of the anesthesia thus produced, but the method could not compete with the perfected gas-oxygen technic, although it has a few advantages even at the present time.

In 1892, Clover renewed interest in prolonged nitrous oxid anesthesia by continuing the narcosis induced in the usual manner by passing the gas through a metal tube into the mouth. In 1898, Coleman revived the use of the nasal inhaler, which Patterson in 1899 modified and adapted to his improved apparatus. In 1902, Kilpatrick improved it by adding an expiratory valve, which could be thrown in or out of action as desired. In the same year Hillard used endo-pharyngeal nitrous oxid anesthesia by means of soft rubber tubes passed through the nares into the naso-pharynx. Teter has since improved the nasal technic by using oxygen and a pressure regulated expiratory valve.

PHYSIOLOGIC BASIS OF REBREATHING.

After years of work, physiologists generally agree that animals that have died in air-tight confinement in which oxygen was supplied and CO_2 removed, death was not due to poisoning from rebreathing exhaled gases, but to ammoniacal decomposition of urine and feces in the cage, and that there is no organic substance in exhaled gases, which is toxic. Herman, Haldane, and Smith have pointed out that CO_2 may reach a 4 per cent. concentration in the air before stimulating respiration. Hill and Flack found that CO_2 up to 35 per cent. in the air breathed stimulated respiration, while higher percentage tensions depressed it; that percentages up to 22 produced a rise in blood pressure, while greater percentages depressed it. They further stated that "the effects of CO_2 on the heart can always be quickly recovered from, even if the blood pressure has sunk to zero." When it is remembered that there is from 40 to 45 volumes per cent of CO_2 normally in the blood, such statements as the above are not startling, and CO_2, except in fair concentration, cannot be regarded as poisonous.

Henderson, in 1908, began the publication of his work on acapnia and shock. He brought forward experiments to support his contention that CO_2 in the blood regulates blood pressure and respiration, and that by rapid or deep respiration the CO_2 content of the blood is reduced, a condition which he termed "acapnia." He further contended that acapnia is the cause of surgical shock, and produced it in dogs by over-ventilating the animal's lungs and blood by means of a pump or bellows. He then successfully relieved the shock and apnea by administering oxygen to sustain the heart until sufficient CO_2 had accumulated in the blood to reestablish respiration. This required several minutes. Respirations were more quickly restored when CO_2 was administered. His conclusions favored the use of rebreathing in anesthesia as a means of avoiding over-ventilation and shock.

Gatch, then of Johns Hopkins, was among the first to put Henderson's theories of acapnia and hypercapnia to the crucial test of clinical application, and at the sixty-second Annual Session of the American Medical Association, at Los Angeles, reported on a series of 2,500 nitrous oxid-oxygen and nitrous oxid-oxygen-ether anesthesias, in Halstead's clinic, by a method of rebreathing, using an apparatus which he had personally devised for accomplishing the technic. The apparatus was simplicity itself. Gatch had the patient exhaust the residual air in the lungs by breathing a mixture of nitrous oxid and oxygen through valves. The bag was then refilled and rebreathing of nitrous oxid with an unmeasured quantity of oxygen was allowed for from five to eight minutes, when the bag was emptied breath by breath through the expiratory valve, and the same process was repeated indefinitely. The amount of oxygen supplied was gauged entirely by the patient's apparent requirements, his condition and the necessary depth of the narcosis. For purposes of relaxation ether was added by dropping it upon drip plates, where the ether, heated by rebreathing, quickly evaporated, and was rapidly absorbed into the blood because of the increased pulmonary ventilation.

This technic of rebreathing, while efficient in the hands of an exceptionally skilled administrator, is inaccurate for routine purposes, and prone to produce hypercapnia, followed by an increase of blood pressure, slowing of the heart and nausea, on the one hand; or acapnia, if the bag is filled too frequently, on the other.

A great impetus to the rebreathing method, however, occurred and anesthetists generally began using it again.

Until 1910, rebreathing had always been accom-

plished as Wells, Clover, Hewitt, or Gatch had practiced it—by allowing the patient to breathe to and fro for a certain time into a bag of anesthetic vapors which was larger than the patient's tidal respiration. This is *total rebreathing,* since the *whole* breath is stored and rebreathed.

FRACTIONAL REBREATHING.

In 1910, I devised the *fractional method of rebreathing* and constructed a special bag for that purpose. The bag is cylindrical, of thin rubber, and attached to a gas tight ring which slips over a cylindrical tube with a perforated bottom. By moving the ring and bag up or down, the capacity of the bag is decreased and increased. The tube being graduated in 100 c.c. divisions, the capacity of the bag is known at all times and may be accurately adjusted as desired. I have termed this the "fractional rebreathing bag," since in use, *only a portion* of each breath is retained for rebreathing. The bag is attached to the gas-oxygen or other apparatus between the supply bags and the inhaler so that on exhalation the rebreathing bag is first filled and the latter part of exhalation escapes from the exhaling valve on the face mask. On inhalation the bag is first emptied and the remainder of the inhalation comes from the fresh gases in the supply bag. In this way the action is automatic, accurate, and free from danger of asphyxia, from lack of control or experience—always a danger when total rebreathing is used.

Fig. 1. McKesson Adjustable Rebreathing Bag for the Fractional Method.

As a means of determining *how much* of each breath should be retained and rebreathed the bag is used to *measure* the *tidal* respiratory capacity of the patient from time to time during anesthesia. This is accomplished by moving the ring and bag down until the bag is just large enough to be filled and emptied with each breath. The graduation on the tube in cubic centimeters represents the tidal volume.

PHYSIOLOGIC BASIS OF THE FRACTIONAL METHOD.

A brief review of some facts in the physiology of respiration will show the importance of this method.

The average lung capacity in forced inhalation is about 3,700 c.c., but the amount of air inhaled and exhaled at an ordinary breath is only about 500 c.c., called the tidal volume.

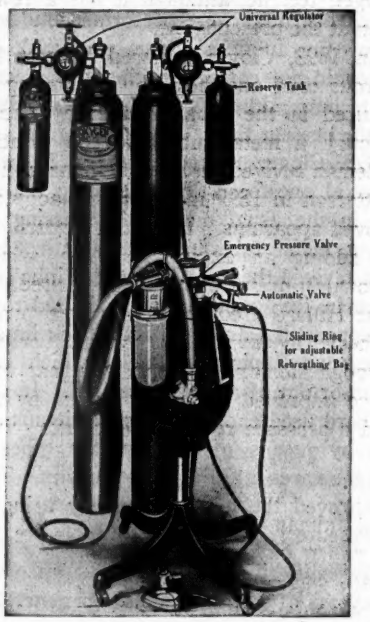

Fig. 2. A Rebreathing Bag Adapted to the McKesson Apparatus.

The tidal respiration may be divided into two portions: the first, which fills the tubes and passages leading *to* the alveoli; and the second, which *occupies* the smaller bronchioles and alveoli where the exchange of gases actually takes place.

The quantity normally contained in the upper air passages and bronchial tree, in which there is *no* CO_2, is 140 c.c., while the second, or alveolar portion, amounts to 360 c.c. and represents the volume of gases actually engaged in respiration.

In selecting the part of the exhalation to be rebreathed, I constructed the apparatus to retain the first portion in order to save the 140 c.c. of unused gases. Since this 140 c.c. contains no carbon dioxid it could be of no other use than the saving of approximately one-fourth of the gases consumed by the patient, and, therefore, represents economy. Moreover, this 140 c.c. has lost none of its nitrous oxid or oxygen to the blood and, therefore, should

not be wasted. If this were all that one would wish to be rebreathed, a 140 c.c. bag to catch these gases only would be simplicity itself. But we must usually be able to save more than 140 c.c. of each exhalation if we are to prevent over-ventilation. The amount actually used for rebreathing must be adjustable and based upon the ventilation of the lungs.

What is the normal ventilation of a sleeping adult? It is the product of the rate of respiration by the volume of gases taken at a breath. This normally amounts to from 7,000 c.c. to 8,000 c.c. per minute for 15 respirations × 500 c.c. = 7,500 c.c. per minute. But the patient in anesthesia often breathes rapidly, 30 times per minute of 500 c.c. or 15,000 c.c. per minute. In other words, he has doubled his ventilation, or over-ventilates. Now, to reduce the ventilation of this patient to normal by means of fractional rebreathing, the bag is set to catch 250 c.c.; half of each breath to be taken at the following inhalation together with fresh gases, to the amount of 250 c.c. At each breath this accurate selection is automatically accomplished, and so long as the respiratory rate or volume does not change, no further adjustment is required, and the patient actually exhales but 7,500 c.c. per minute, although the respiratory movements would doube this amount if half of each breath were not rebreathed.

Rapid breathing in anesthesia, especially with N_2O, is probably due to restricting oxygen in the nerve cell to amounts capable of supporting life functions only. This oxygen restriction sets up a protective train of impulses resulting in rapid respirations, for it is common knowledge among N_2O-O anesthetists that a rich oxygen mixture for two or three breaths will invariably slow, and sometimes even stop, respiratory efforts for several seconds, but as the surplus of oxygen is consumed, the patient soon resumes rapid respiration. With ether, the oxygen restriction is probably of a chemical nature.

The rate of respiration in N_2O-O anesthesia depends largely upon the oxygen content of the mixture administered, increasing as the oxygen is decreased until such a point is reached that anoxemia begins to produce convulsive movements.

These rapid respirations, resulting in over-ventilation, eliminates more CO_2 from the blood than normal, which in some patients causes a decreased volume of respiration, thus partially correcting the over-ventilation. In the majority of patients, however, associated with this rapid respiration, other symptoms indicative of shock appear, such as increasing pulse rate, weakened heart contractions, as shown by the decreased pulse pressures, as well as decreased systolic and diastolic blood pressures.

While over-ventilation is only one among the causes of surgical shock and not even as important as trauma, it is almost invariably associated with shock from any cause and may always be a contributing factor when present. It is, therefore, of importance that this cause be carefully eliminated in each case.

There are variations in the production and elimination of CO_2 by the body, notably in the variable amount of muscular contraction, food taken, etc.; but under the conditions usually encountered on the operating table with the patient properly prepared for operation, these variations are not so wide.

In clinical practice, therefore, we may prevent over-ventilation by allowing the patient to exhale between 7,000 and 8,000 c.c. of gases from the apparatus per minute, the normal for sleeping conditions. Thus the elimination of an excessive amount CO_2, and in so far as this augments shock from any cause, it may be prevented.

TECHNIC.

The rate of respiration is determined, then the tidal volume is obtained by setting the rebreathing bag where it is just large enough to hold an exhalation and to accommodate inhalation. The volume of the bag now represents the tidal respiration and the position of the ring on the graduations indicates the volume in c.c. Then the bag is decreased in capacity by elevating the ring as much as it is desired the patient shall obtain of fresh gases, and also exhale alveolar gases at each breath. The balance is to be rebreathed.

Respiration rate.	Fresh gas to be inhaled and Alveolar gases to be exhaled.		Normal ventilation.
15	X	500 c.c.	7500 c.c.
20	X	375 c.c.	7500 c.c.
25	X	300 c.c.	7500 c.c.
30	X	250 c.c.	7500 c.c.
35	X	210 c.c.	7500 c.c.
40	X	185 c.c.	7500 c.c.
45	X	166 c.c.	7500 c.c.
50	X	150 c.c.	7500 c.c.

Referring to the table, suppose the patient breathes 25 times per minute, and that the tidal volume is found to be 550 c.c. at a breath; then the amount of fresh gases to be taken and alveolar gases to be eliminated at each breath to maintain a normal ventilation would be 300 c.c. The bag is, therefore, decreased by raising the ring 300 c.c. from 550 c.c.; then the amount to be rebreathed would be the amount above the ring, or 250 c.c. With each breath the patient thus inhales 250 c.c. from, and empties the rebreathing bag, while the remainder of the inhalation, 300 c.c., comes from the supply bags filled with fresh gases. On exhal-

ing, the rebreathing bag catches the first 250 c.c. to leave the air passages, but as soon as it is filled the latter portion of exhalation, or the following 300 c.c. escapes automatically from the valve at the inhaler, and is thus eliminated from the apparatus. To repeat, the fractional method permits us to accurately limit the amount of gases actually exhaled per minute to the normal sleeping elimination of 7,000 c.c. to 8,000 c.c.

Since using the fractional method of rebreathing, I have found that with a tidal volume of less than 300 c.c., the resulting anesthesia under nitrous oxid-oxygen is often unsatisfactory, doubtless due to an inadequate exposure of the gases in the alveoli for absorption. This fact may account for the efforts made by earlier investigators to improve nitrous oxid-oxygen anesthesia by its administration under increased atmospheric pressure; and it explains Gwathmey's conclusion that: "Five m.m. of mercury pressure in the rebreathing bag have been found a very great help in those subjects usually considered unsuitable for nitrous oxid-oxygen." The increased pressure under these circumstances restricts ventilation in the alveoli and through the CO_2 retention, stimulates larger respiration, which increases the absorption of gases and thus deepens anesthesia. It is not probable that such a small increase in the gaseous pressure would in itself materially increase absorption.

When an adult patient has a tidal volume of 300 c. c. or less, the rebreathing bag should be set so that a considerable portion of this is rebreathed for a minute or so until enough CO_2 is thus retained to increase the *depth* of respiration to about the normal, or 500 c. c. When the normal volume is secured, the rebreathing bag is readjusted on the basis of the rate of respiration previously described. Generally, the volume may not be increased *above* the normal without stimulating the rate of respiration, which is usually undesirable. The increased volume of respiration exposes more gas-oxygen to the blood for absorption, and a deeper anesthesia is obtained without changing the mixture of gases. Within certain limits rebreathing may be used to stimulate the *depth* of respiration, while the *rate* may be varied somewhat by the proportion of oxygen in the mixture. The latter, however, is less susceptible of manipulation.

An exceptionally valuable feature of the fractional rebreathing device is that it automatically selects those gases coming from the upper air passages to be retained for rebreathing and eliminates from the apparatus most of the latter portion of exhalation, coming from the deeper and alveolar portions of the lungs, which contains 6 per cent. of carbon dioxid and is poor in anesthetic properties.

That rebreathing will favorably influence the precarious condition of hazardous risks has been abundantly proven in Gatch's experience and my own.

The manner in which rebreathing may be used to influence the condition of a patient is shown in the accompanying chart of one of my cases.

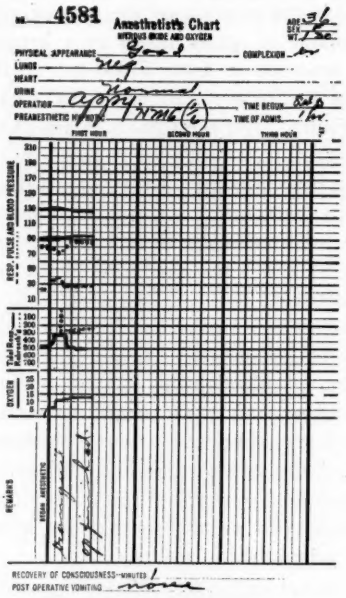

Fig. 3. Illustrative Chart.

CASE I. Shortly after beginning this anesthesia for an appendectomy, the tidal respiration was but 300 c.c. In the second five-minute interval, rebreathing was set for 300 c.c. as shown by the dotted line in the middle section of the chart. In two or three minutes the tidal respiration began to increase until it reached 500 c.c., when the rebreathing bag was set for 250 c.c., as the rate of respiration was 30 per minute, indicated by the broken line. This chart also illustrates the slowing of the respiratory rate when the oxygen percentage is increased; also, the influence of rebreathing in maintaining blood pressure, and thereby acting as a prophylactic measure against the insidious onset of shock.

The occasional necessity of administering ether with nitrous oxid and oxygen usually caused by faulty preparation of the patient, mistakes of the anesthetist, or roughness by the surgeon, does not interfere with the routine use of fractional rebreathing. In fact, an extraordinarily safe and efficient nitrous oxid-oxygen anesthesia with fractional rebreathing may be readily maintained with an exceedingly small amount of ether.

Excessive ether percentages which were a constant factor in the older methods of etherization by closed cones with rebreathing have been shown by Ladd and Osgood to have been responsible for the occurrence of acetonuria in 88 per cent. of pa-

tients thus anesthetized. With the open drop method of etherization this percentage falls to 25. In nitrous oxid-oxygen-ether anesthesia with fractional rebreathing of post-anesthetic acidosis is negligible.

The following case from my practice illustrates the value of rebreathing and oxygen in collapse:

CASE 2. Following an abdominal operation of ordinary severity, the patient, a man of moderate build, in the twenties, who had been anesthetized with ether, apparently "fainted." The patient had been in bed about one hour, had regained consciousness and seemed so well that his relatives had left the hospital half an hour before the incident occurred.

The nurses failed to revive him by their usual treatment for fainting. The pupils were widely dilated, pulse imperceptible, pallor and perspiration marked, with no effort at respiration. They began artificial respiration and sent word to the operating room. It was ten minutes before I was able to leave the patient I was then anesthetizing, but shortly after that found the patient as above described, but cyanosed slightly, still making no voluntary respiratory efforts.

I then inflated the lungs with pure oxygen three times in about ten seconds to make sure that the supply of oxygen was adequate to support the heart. I then held the mask against the face and waited half a minute by the watch. There was no respiratory effort, but the cyanosis faded slightly. His lungs were again inflated with oxygen and another half-minute wait still failed to develop the slightest respiratory effort. And so the O inflations were continued as described for six and a half minutes before feeble respiratory efforts began. In the meantime the pupils gradually began to contract, although still large, when respirations resumed. The pulse was still imperceptible at the wrist.

During the next fifteen minutes he quite rapidly increased the volume of respiration under the stimulating influence of rebreathing. The rebreathing bag was kept within 50 c.c. of his tidal volume, so that but a small portion of each breath escaped. When the pupils were normal, the pulse strong, and the patient was again rational, the method was discontinued. The patient made an uneventful recovery after this collapse.

During the period while we were waiting for respiration to be started by CO_2 in the blood, oxygen was administered to save the heart from anoxemia, taking care that the ventilation would be well below normal, and thus allow CO_2 to accumulate. The oxygen by the rebreathing method, I believe, saved the patient. If a high percentage of CO_2 had been thrown into the lungs and circulation, would it have started respiration as it did when the heart was sustained while CO_2 gradually accumulated in the blood? I do not know. It might quite easly *overcome* the tendency to respiration if administered in too strong concentration. How strong should CO_2 have been if it had been used? Under the conditions of the circulation I believe it quite impossible to judge. I prefer rebreathing and pure oxygen, which has also given me good results in several illuminating-gas asphyxias. In most of these latter cases, breathing was reestablished within ten minutes, and if the case was seen early, complete recovery followed in five to thirty minutes.

Rebreathing during the administration of nitrous oxid-oxygen will not only control the tendency of preliminary alkaloidal medication to decrease the rate and the volume of pulmonary ventilation, but will also, in association with over-ventilation with oxygen and carbon dioxid, combat the effect of morphin in preventing the elimination of ether from the system, if ether is used.

In conclusion, it may be stated that rebreathing is a perfecting detail in the administrative technic of nitrous oxid-oxygen anesthesia, and that the *fractional method of rebreathing* made possible by the fractional rebreathing bag:

(1) Affords a practical means of measuring the tidal respiration.

(2) Selects automatically those gases coming from the upper air passages to be retained for rebreathing, and eliminates from the apparatus the latter portion of the exhalation coming from the alveolar portion of the lungs, which contains 6 per cent. carbon dioxid, and is poor in anesthetic properties.

(3) Controls the tension and elimination of concomitant etherization when employed.

(4) Prevents the rapid breather from using more gas, per minute, than he would use of air, if normally asleep.

(5) Makes the light breather increase the depth or volume of respiration, thus securing a better absorption of the anesthetic and a more satisfactory plane of narcosis.

(6) Reduces gas consumption to accuracy, and to an economic basis, which puts the technic within reach of all.

2233 ASHLAND AVENUE.

FEATURES IN THE APRIL SUPPLEMENT

OIL-ETHER COLONIC ANESTHESIA, THE LATEST TECHNIC.

JAMES T. GWATHMEY, M.D.,
New York City.

PROCEEDINGS OF THE AMERICAN ASSOCIATION OF ANESTHETISTS.

MEDICO-LEGAL ASPECTS OF ANESTHESIA AND ANALGESIA.

(Concluded)

¶ At the time of going to press, the SUPPLEMENT is in receipt of a communication that it has been made the Official Organ of the PROVIDENCE (R. I.) SOCIETY OF ANESTHETISTS.

¶ Editorial arrangements are in progress to secure a number of articles from well-known authorities on the HISTORICAL EVOLUTION OF ANESTHESIA AND ANALGESIA. These articles will be based on original researches and documents, and will serve to correct many errors that have become traditional, on account of constant repetition, without any warrant of fact.

American Journal of Surgery

QUARTERLY SUPPLEMENT of ANESTHESIA and ANALGESIA

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Original Articles, Clinical Reports and Experimental Researches on the Theory and Practice of Anesthesia and Analgesia, as well as pertinent Society Transactions, are solicited for exclusive publication in this Supplement.
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F. HOEFFER McMECHAN, A.M., M.D., *Editor*
Cincinnati, Ohio, U.S.A.

Vol. I. No. 2. JANUARY. 1915

"Even as a surgeon minding off to cut
Some cureless limb, before in use he puts
His violent engines in the victim's member,
Bringeth his patient in a senseless slumber,
And griefless then, guided by use and art,
To save the whole, saws off the infested part."
Dubartas, 1592.

WORTHY OF HIS HIRE,

While the Committee of the Ohio State Medical Association has found that the awards paid to physicians and surgeons by the Ohio Industrial Commission, under the provisions of the Workmen's Compensation Law, are higher than those scheduled in New York or any other state, there is still room for improvement, notably in respect to the fee paid the anesthetist.

The Ohio Industrial Commission has arbitrarily fixed the anesthetist's fee at five dollars ($5.00) irrespective of the inherent hazard of the case, the time and skill of the administrator and the method of anesthesia involved.

It is conceivable that a fee of five dollars may be a remuneration of sorts for local analgesia in the operative procedures of minor surgery, or a brief ether *rausch*, but when life hangs by a thread, and the anesthetist is called upon to prevent the occurrence of an operative death, involving an award of several thousand dollars, the five dollar fee is ridiculously inadequate in comparison with the importance and value of the services rendered.

Moreover, such an arbitrary, minimal fee precludes the use of nitrous oxid-oxygen anesthesia for extra hazardous risks, as the anesthetist would have to furnish the apparatus and gases required and do the work at a personal pecuniary loss. Hospitals cannot and will not stand for this additional drain out of the five dollar fee allowed for operating room expenses.

The Ohio Industrial Commission is to be commended for promulgating the following rule:

"Fees covering services rendered by internes connected with a hospital shall not be paid from the state insurance fund."

This regulation not only saves the victim of an accidental injury from being anesthetized by an incompetent tyro, but reserves the work for the expert to whom it rightfully belongs.

The preceding rule is further emphasized in the following regulation:

"Fees covering services rendered by an assistant or an anesthetist shall not be paid from the fund unless such services are performed by a physician, and a separate fee bill covering such services presented by him. The necessity for the services of a consultant, assistant or anesthetist must be clearly apparent from the nature and extent of the injury before fees for such services shall be approved for payment from the state insurance fund."

This regulation effectively disposes of the nurse anesthetist in workmen's compensation cases, and the separate fee bill prevents the penurious surgeon from now treating the anesthetist as a charitable adjunct of the operating room staff. Those surgeons who, through a mistaken sense of economy, persist in having their anesthetics administered by others than licensed practitioners, would do well to reflect on the decision of the Supreme Court of the State of Louisiana in the case of *Nations* vs. *Ludington, Wells & Van Shaick Lumber Co.*, in which it was held that employing a non-medical anesthetist, however experienced, with no emergency existing, constituted negligence, and the damages awarded by the trial court to the plaintiff were increased to $10,000.

Be that as it may, if the anesthetist is at all worthy of his hire, it would seem that the question of the anesthetist's fee under the provisions of recently enacted Workmen's Compensation Laws is a matter for the immediate attention of the American Association and New York Society of Anesthetists.

The New York Society of Anesthetists is alreay displaying commendable activity in the matter and at the November meeting of the organization a legislative committee of three members was appointed to investigate the question and report on a solution for the problems involved.—F. H. M.

THE AMERICAN ASSOCIATION OF ANESTHETISTS WILL HOLD ITS THIRD ANNUAL MEETING DURING THE PANAMA-PACIFIC EXPOSITION, AT SAN FRANCISCO, JUNE 19, 1915.

Medico-Legal Aspects of Anesthesia and Analgesia.

Editor's Note.—Periodically the Supplement will review American and Continental Court decisions involving the relations of Anesthetists and Surgeons to Anesthesia, Analgesia and the Law.

SURGEON NOT LIABLE FOR DEATH DUE TO ANESTHETIC ADMINISTERED BY MEDICAL STUDENT.

The deceased in this suit of *Levy (Administrator) vs. Vaughan,* was an over-weight hazardous risk, who was anesthetized by a medical student, who, while he had witnessed anesthetics administered in a large number of cases, had actually administered ether, before, in but eight or ten cases. The open-drop method with an Esmarch mask was the technic employed. The induction of anesthesia was attempted in the anesthetic room, under the general supervision of two house-physicians, who were in an out of the room during the 35 minutes required to get the patient under the influence of the anesthetic; about 3 ounces of ether being used. No complications presented until after the patient had been lifted on the operating table, when he was noticed to be cyanotic. The defendant felt the patient's pulse and immediately instituted artificial respiration, which proved temporarily beneficial, and the patient was returned to the ward, unoperated. Cyanosis persisted and, despite the use of resuscitative measures, the patient succumbed. Autopsy revealed fatty degeneration of the heart.

The Court of Appeals of the District of Columbia held that a verdict for the defendant had been properly directed, and affirmed judgment with costs. The court held that there was no evidence whatever of negligence, either in the preliminary examination of the patient or in the administration of the ether, by a student of the description given; as the evidence in behalf of the plaintiff showed that two experienced house-physicians were present, generally, during the induction of narcosis, in a supervisory capacity. That they were employed by the hospital and had not been provided by the defendant, was wholly immaterial, as was the fact that these interns were licensees of a state other than the District of Columbia. They were not practicing medicine in the District, but were employed in the hospital and had been shown to be competent.

DEATH FROM A NON-ABORTIVE ANESTHETIC.

In *State of Ohio vs. Tippie,* the Supreme Court of Ohio held that:

"Whoever, with the intent to procure the miscarriage of a woman by the use of an instrument or other means, administers to her a non-abortive drug as an anesthetic preparatory to the use of such instrument or other means of procuring an abortion, and the woman dies in consequence of the administering of such drug before the use of instruments or other means by such person to procure such miscarriage, and it does not appear that such contemplated miscarriage is necessary to preserve her life, or that the procuring of such miscarriage was advised by two physicians to be necessary for that purpose, is guilty of a violation of the provisions of Section 12412, General Code.

"Under such circumstances every act done and performed in furtherance of such unlawful purpose is an integral part of the whole unlawful transaction; and the fact that death ensues before the final act in the contemplated crime can be accomplished, is not a defense to an indictment charging a violation of this section.

"If it appear that a non-abortive drug is administered to a woman as an anesthetic to enable a duly authorized and practicing physician fully and carefully to examine into the woman's actual condition for the purpose of determining if it be necessary to produce a miscarriage in order to save her life, and the woman dies from the effect of the drug so administered, and no miscarriage is performed, nor intended to be performed unless the examination discloses that it is necessary to preserve the woman's life, no offense has been committed within the provisions of Section 12412, General Code.

"Evidence tending to show that no secrecy is maintained in the transaction, that a second physician is called in to administer the anesthetic, that while the woman is in a state of anesthesia the attending physician makes an examination for the purpose of determining whether the fetus is alive or dead, and upon such examination does determine that the fetus is still alive and that it is not necessary to procure a miscarriage in order to preserve the woman's life, and having so determined, makes no use of any instrument or other means to procure a miscarriage, but immediately desists from further efforts in that direction, and directs that the woman be restored to consciousness, is proper evidence to be admitted for the purpose of showing the absence of criminal intent in administering the anesthetic." *(105 N. E. R. 75.)*

LIABILITY OF EMPLOYER FOR DEATH OF EMPLOYEE UNDER OPERATION, WHEN LAYMAN ADMINISTERS THE ANESTHETIC.

In the case of *Nations vs. Ludington, Wells & Van Schaick Lumber Co.*, the patient, a laborer, died from the effects of the anesthetic before the operation was begun. The Supreme (Appellate) Court of the State of Louisiana held that employing a non-medical anesthetist, with no emergency existing, constituted negligence, and increased the damages, awarded by the trial court to the plaintiff, to $10,000. The Supreme Court was emphatic in its declaration that in the case adjudicated, one contemplating minor surgery only, a physician should have been employed to administer the anesthetic, although the officiating anesthetist was experienced in this line of work, and administered the anesthetic in the presence and under the direction of the surgeon. *(Medical Record,* February 28, 1914.)

(To be continued.)

Book Reviews

A carefully selected library is essential to a thorough knowledge of the science and practice of a specialty.

Local Anesthesia. By CARROLL W. ALLEN, M.D., F.A.C.S. Instructor in Clinical Surgery at Tulane University of Louisiana. With an introduction by RUDOLPH MATAS, M.D., F.A.C.S., Professor of Surgery at Toulane University. Octavo of 625 pages, with 255 illustrations. W. B. SAUNDERS, Publishers, Philadelphia, 1914. Price, cloth, $6.00.

In the revival of interest in general anesthesia and in local and regional analgesia, the tide of contemporaneous literature has swung from the continent to America.

Allen's volume, just off the press, is a complete and individual exposition of the various phases of local and regional analgesia. The historical evolution, principles, physiology, toxicology and technic of the subject are exhaustively covered and handled in a masterly manner. To enable the reader to secure a clearer insight into the causality of pain, a chapter is devoted to the nerves of sensation, their areas of distribution and association with the sympathetic system. Valuable advice is suggested regarding the psychic control of pain.

The principles of osmosis and diffusion, of various analgesics in combination and solution, on which the effectiveness of local and regional analgesia depend, are adequately considered and explained. Especial attention is devoted to cocain and novocain, their action on the nervous system, the control of their toxicity and the value of adrenalin as an adjuvant. Also the peculiar obtunding effects of quinine and area, the magnesium salts and potassium sulphate are dilated upon.

Perhaps the most valuable feature of this volume is the minute detail with which the technics for spinal and epidural analgesia, paravertebral, parasacral, intrarterial, and intravenous anesthesia are described. These technics are amplified by numerous illustrations of exceptional merit in explaining difficult injections, and illuminating routine procedures.

Crile's latest accomplishments in anoci-association and his method of adrenalin-saline transfusion are included as valuable aids in obtunding sensitive tissues and operative areas, and in preventing the occurrence of shock or in treating the condition once it has supervened.

The scope of Allen's book can only be fully appreciated when it is realized that he has detailed and illustrated all the various methods of local and regional analgesia as they apply to rectal, genito-urinary and gynecological surgery and to operative procedures upon the head, eye, ear, nose and throat as well as the extremities.

Even the subject of dental anesthesia is exhaustively considered.

While Allen has scoured the world's literature to encompass his subject, his volume emphasizes the value of those methods and details of technic, which from personal experience he has found to be the easiest and most efficient.

Local Anesthesia: Its Scientific Basis and Practical Use. By PROF. DR. HEINRICH BRAUN, Chief-of-Staff and Director of the Royal Hospital at Zwickau, Germany. Translated and edited by PERCY SHIELDS, M.D., A.C.S., Cincinnati, O., from the *Third German edition*, with 215 illustrations in black and colors. Octavo; 399 pages. Price, $4.25. LEA & FEBIGER, Philadelphia, 1914.

Attention has already been drawn to the fact that the American edition of this work cost the translator his life; but it was worth the effort and it fulfills in a most efficient manner Dr. Shields' purpose, as expressed in the preface, written just before his untimely death:

"My object in placing Braun's work at the command of the English speaking surgical profession is to systematize the vague, erratic and unsatisfactory efforts which have been made in this field for many years, by offering a logical procedure, based upon scientific facts, and having an exact and undeviating technic."

This volume of Braun's may be truly termed a classic, and it stands as another monumental achievement of a medical genius' infinite capacity for taking pains. This *third edition* records not only a widespread popularity for the book itself, but an intrinsic development of the subject that has put analgesia on a secure and scientific basis, and rendered it adaptable to practically every known operation of surgery and its co-related specialties.

While Braun has had exceptional opportunities for developing the scope of local analgesia, both in general surgery and the specialties, he has not hesitated to incorporate the best work of the master-minds of both continents on analgesia, and he graciously acknowledges an especial indebtedness to the cooperation of Prof. Schwarz and Dr. Viereck.

Braun's review of the historical evolution of analgesia up to the discovery of cocaine is, to say the least, as interesting as it is exhaustive. His consideration of the osmotic tension of watery solutions and tumefaction and dehydration analgesia lays a basic foundation of physiological principles for the technics of infiltration and conduction anesthesia.

After extensive experiments with all known analgesic agents, Braun now utilizes, almost exclusively, novocain amplified by suprarenin. Hertzler's and Crile's notable successes with quinine and urea hydrochloride as an important adjunct to local analgesia seem entirely to have escaped Braun's observation.

Braun describes in detail not only the many novelties of his instrumentarium and the routine percentage solutions of the analgesic agents, but also gives the minutest directions regarding the general technic of infiltration and conduction analgesia, in respect to cutaneous cataphoretic, subcutaneous, peri, endoneural, lumbar, sacral, epidural, paravertebral, venous and arterial anesthesia.

The latter half of the book is devoted to the practical application of the technics of infiltration and conduction anesthesia to every conceivable sort of operative procedure. Readers of the previous German editions will be surprised by the number of new illustrations that have been added. They are especially striking because the photographs were taken during the course of actual operations, and the absence of any expression of pain on the faces of the pa-

tients is a remarkable advertisement of the absolute efficiency of the analgesic methods described.

Anesthesia and Analgesia. By JOHN DESMOND MORTIMER, M.B. (Lond.), F.R.C.S. (Eng.) *First edition*, 276 pages; 29 illustrations. WILLIAM WOOD & Co., New York, 1914. Price, $2.00.

This volume on anesthesia and analgesia has been written, not so much from the point of view of the specialist, as that of the general practitioner and surgeon. Much of the routine matter usually included in text-books on anesthesia has been omitted, but on the contrary such important subjects as the preparation and after treatment of the patient, the selection of the anesthetic, the difficulties peculiar to certain operations, and the relative advantages of anesthesia and analgesia have been fully considered.

The chapter on the anesthetist's equipment, and his preparedness for such accessory operations as laryngotomy, tracheotomy, saline transfusion, lavage of the stomach, and measures for artificial respiration, is admirably conceived and replete with valuable suggestions.

Likewise the chapters devoted to the selection of the anesthetic, in reference to the patient and contemplated operative procedure; posture during anesthesia, and teamwork between surgeon and anesthetist are pregnant with practical information.

In no other volume on the subject is there such a masterly exposition of reflexes under anesthesia, and how they may be controlled by a mutual understanding between the operator and the anesthetist.

The tyro is told how to meet the difficulties, dangers and emergencies arising under anesthesia, and the expert may learn some useful practices from Mortimer's postanesthetic regimen.

While the routine procedures of spinal and local analgesia are succinctly considered, no effort has been made to compete with the more extensive monographs on these subjects. The book closes with a very interesting and instructive chapter on the medico-legal position of the anesthetist.

The routine observance of Mortimer's invaluable suggestions in his practical manual will go far in enabling the anesthetist to establish cordial relations between his patients, his operating surgeons and himself.

Index and Abstracts

A Résumé of the International Current Literature of Anesthesia and Analgesia.

EDITOR'S NOTE: Authors of pertinent articles, who desire to have them indexed and abstracted, are cordially invited to send copies of the journals containing their contributions, direct to the editor, immediately on publication. Also the receipt of reprints for filing and reference will be duly appreciated.

ACETONURIA FOLLOWING SPINAL ANESTHESIA. G. Gellhorn, St. Louis. Zentralblatt für Chirurgie, August 29, 1914.

ADRENALIN-COCAIN SURFACE ANESTHESIA. R. S. Cauthen, Charlotte, N. C. Southern Medical Journal, October, 1914.

ANESTHESIA, PHASES OF. J. A. Kirk, Louisville. Kentucky Medical Journal, August 15, 1914.

ANESTHESIA, PROGRESS IN GENERAL INHALATION. D. Kulenkampf. Deutsche medicinische Wochenschrift, September 7, 1914.

ANESTHETIC, CHOICE OF, IN OPERATING FOR ABSCESS OF THE LUNG. F. T. Murphy, St. Louis. Annals of Surgery, July, 1914.

ANESTHETIC POWDER, DUSTING WOUNDS WITH, BEFORE SUTURING. G. Hotz. Muenchener medicinische Wochenschrift, July 21, 1914.

ANESTHETIC, SELECTION OF. E. R. Horine, Louisville, Ky. Kentucky Medical Journal, October 15, 1914.

ANESTHETISTS, NON-MEDICAL, AND THE LAW. L. Irwell, Buffalo. New York Medical Times, September, 1914.

ANOCI-ASSOCIATION,—EVOLUTION OF SHOCKLESS OPERATIONS. H. M. W. Gray, London. British Medical Journal, August 22, 1914.

ANOCI-ASSOCIATION ANESTHESIA, EXPERIENCES WITH. E. C. Davis, Atlanta. Georgia Medical Association Journal, August, 1914.

ANOCI-OPERATING. W. P. Carr, Washington, D. C. Virginia Medical Semi-Monthly, October 9, 1914.

Anoci-Association in the Prevention of Shock and Post-Operative Discomforts. H. B. BUTLER and E. W. SHEAF, *British Medical Journal*, July 18, 1914.

Basing their opinion on 143 major operations performed under anoci-association, Butler and Sheaf conclude that it is ideal in preventing shock and ameliorating post-operative discomforts. Ward and Home Sisters who started out by being sceptical, are now quite convinced of its advantages, and declare that patients operated under anoci-association are no trouble after operation.

In two amputations through the thigh in old people, in addition to the usual novocain infiltration, the sciatic nerve was injected with quinine and urea, and there was no shock and practically no after-pain.

One girl of 17 years had a large one-sided goitre, which caused her great pain and dyspnoea. The operation for removal was conducted without the slightest anxiety, and recovery was normal and rapid. The same patient was subsequently operated on by another surgeon for enucleation of the tonsils and died under the anesthetic.

Necroscopy revealed status lymphaticus. This would seem to indicate that anoci-association saved her from disaster on the occasion of the first operation.

So far there has been no trouble in the healing of the operative wounds.

APPARATUS,—IMPROVED ETHER INHALER. A. E. Gallant, New York Medical Journal, October 31, 1914.

Arterial Hypertension and Hypotension in Medicine and Surgery. H. H. ROBERTS, M.D., Lexington, Ky. *Southern Medical Journal*, September, 1914.

Roberts insists that during an operation there is nothing which will give the surgeon more reliable information as to the patient's condition than the repeated taking of the blood pressure by means of a sphygmomanometer. Preliminary measurement of the normal systolic pressure of the patient is one of the essentials in determining the vital resistance for any contemplated surgical procedure.

The effect of any anesthetic is exerted chiefly on the circulation, and the ability to withstand anesthesia safely depends in great measure on the integrity of the vasomotor and cardiomotor systems in maintaining blood-pressure at its normal level. The sphygmomanometer with an enlarged dial for easy reading should be used for ascertaining the circulatory tension at frequent intervals during the course of all operations. A fall in blood-pressure will give warning of impending danger long before any untoward symptoms of the pulse or respiration can be noted. In fact, the anesthetist opens himself to criticism if he neglects this precautionary method of anticipating the occurrence of shock.

The surgeon should realize that unnecessary manipulations of exposed viscera, their vessels, nerves, pedicles or messenteries, are productive of a determining fall in blood pressure, and the onset of surgical shock from trauma may be very precipitous. If the blood pressure falls as low as 100 mm. the danger line has been reached, and operative manipulations should cease, while saline solution is given, especially in the presence of hemorrhage.

Ordinarily during the induction of anesthesia there is a rise of tension due to stimulation of the cardiomotor and vasomotor centers through excitement or the anesthetic agents themselves, notably nitrous oxid and ether. Hypertension under nitrous oxid may become dangerous, unless asphyxia is absolutely controlled by the concomitant use of oxygen. Ether acts as a preliminary stimulant and raises blood-pressure slightly, and depression only follows after lengthy administrations, when too deep a degree of surgical narcosis has been maintained and muscular relaxation has been extreme. On the contrary, in

patients with hypotension, chloroform may cause sudden death by an abrupt drop in blood pressure, although the sphygmomanometer, in routine use, will do much to obviate such preventable catastrophies.

It is a mistake to use the sphygmomanometer only in the operative room or in the preliminary taking of the blood pressure. In hazardous risks the blood-pressure should be taken at intervals after the patient's return to bed to anticipate postoperative collapse.

BLOOD PRESSURE DURING ANESTHESIA AND ANALGESIA FOR DENTISTRY. E. I. McKesson, Toledo. New Jersey State Dental Journal, September, 1914.

CARDIAC FIBRILATION AND ITS RELATION TO CHLOROFORM ANESTHESIA. J. A. McWilliams. British Medical Journal, September 19, 1914.

CHLOROFORM ANESTHESIA. E. C. Fisher, Richmond, Va. Virginia Medical Semi-Monthly, October 9, 1914.

CHLOROFORM AND ETHER ANESTHESIA, EFFECTS OF, ON PROTEIN CONTENTS OF BLOOD SERUM OF RABBITS. L. W. Buck, San Francisco. Journal of Pharmacology and Experimental Therapeutics, July, 1914.

Chloroform Toxicity and Hepatic Necrosis, Influence of Diet on. E. I. OPIE and L. B. ALFORD, St. Louis. *Journal American Medical Association,* March 21, 1914.

By laboratory experiment and clinical results, Crile has pointed out the necessity for preserving the glycogenic functional activity of the liver, particularly in the presence of acidosis complicating operation and anesthesia. This view is supported by Opie and Alford, who, in carrying out their experiments upon animals, using chloroform as an anesthetic, and employing fats and meats, as well as carbohydrates as foodstuffs, found that animals which received a preoperative diet of carbohydrates all survived; whereas all of those receiving fats and meats died from the effects of the anesthetic. Microscopic examination of the liver in starch-fed animals showed scanty areas of necrosis, while in those under a fat and meat diet the hepatic necrosis involved from two to three-fifths of the lobules. This pernicious action of chloroform is probably due to its sollubility and diffusibility in fats, which thereby determines its activity on the liver, resulting in pronounced necrosis.

Clinically it is therefore advisable to feed cardiac, renal and diabetic acidosis risks on gruels, supplemented by taka-diastase and pancreatin, up to within three hours of operation, and to establish this diatery as soon as possible after the anesthetic.

DANGERS OF ANESTHESIA, RECENT EXPERIMENTS DEFINING. Yandel Henderson. Surgery, Gynecology and Obstetrics, September, 1914.

DEATHS, ANALYSIS OF, OCCURRING IN THE COURSE OF 1,573 OPERATIONS. E. MacD. Stanton, Schenectady, N. Y. Albany Medical Annals, August, 1914.

DEATH DURING TONSILLECTOMY FROM REFLEX INHIBITION. H. Dupuy. New Orleans Medical and Surgical Journal, August, 1914.

Dentin, Anesthesia of the, With Albargin. DR. LICHTWITZ. *Dental Cosmos,* August, 1914.

Lichtwitz finds that albargin, a combination of silver nitrate with gelatose, answers all possible requirements as an obtunding analgesic for hypersensitive dentin. It is conveniently applied with a double-headed ball and spatula burnisher. It can be satisfactorily applied in hyperesthesia of the dentin at the cervical margin with incipient caries, in erosions, in hypersensitive dentin which is to be excavated in cavity preparation, in grinding teeth for crown and bridge work, in hyperesthesia due to close bite or attrition, and the carious deciduous teeth of children, in apthae and all other inflammatory conditions in which silver nitrate is indicated.

A fragment of an albargin tablet is pressed upon the hypersensitive field of operation, where it is left adhering for the desired length of time. To prevent its dissolution the field is kept dry. It is rarely necessary to prolong the application beyond a period of five minutes, or to repeat the application.

A single application of albargin, in Lichtwitz's experience, has controlled the progress of caries in deciduous teeth during a period of two years; and has controlled hyperesthesia of the dentin at the cervical margin for as long as one year. In excavating hypersensitive cavities or in grinding down teeth, the effect of albargin as an analgesic is more prolonged than that of phenol, cocain, perhydrol or any other medicaments.

DIFFERENTIAL ATMOSPHERIC PRESSURE PROCEDURES. Berliner Klinische Wochenschrift, September 7, 1914.

DREAM, AN ETHER ANESTHESIA, PARTIAL ANALYSIS OF. J. E. Lind. Alienist and Neurologist, August, 1914.

ETHER ANESTHESIA. G. L. Closson, Seattle. Northwest Medicine, September, 1914.

ETHYL CHLORIDE, INDUCTION OF ANESTHESIA AND. C. Dederer, Los Angeles. California State Journal of Medicine, October, 1914.

Fearful Patients, Anesthesia For. H. SCHOLZ. *Beiträge zur klinischen Chirurgie,* June, 1914.

While patients who dread an operation may attempt to conceal their fear, under a placid exterior, their dread is generally revealed by some disturbance of visceral or vasomotor innervation, such as tachycardia, pseudo-angina, polyuria, glycosuria, diarrhea, angioneurotic edema, shallow and sighing respiration, pallor and dryness of the mouth. Scholz, in studying the condition of fearful patients, coming to operation, concludes that abnormal fear, alone, will precipitate acapnia. Such subjects are also prone to exhibit reflex syncope, during the induction of anesthesia, on account of the irritation by the anesthetic vapors of the nasal terminals of the trigeminus, and coincidentally the terminals of the vagus in the heart and in the respiratory centers of the medulla. Rosenberg has found that cocanization abolishes this reflex, and Gwathmey overcomes it by the use of essence of bitter orange peel.

Fearful patients suffer a constant decline in blood-pressure during the induction of anesthesia by ether or chloroform, the average decrease being 45 mm. of mercury in 15 minutes, or until the stage of surgical narcosis has been reached. Even then further decreases may be noted during visceral manipulation.

Scholz considers the persistence of a dilated pupil, during the induction of chloroform anesthesia, as a sign of impending danger. Also it is possible to induce fainting from sheer fright, if fearful patients, who are struggling, are too forcibly controlled.

Scholz corroborates the views of MacCardie on disasters occurring in the Trendelenburg posture, and illustrates his contention with roentgenograms of anesthetized dogs, showing the remarkable displacement of the diaphragm due to changes in posture. Collapse in the head-down position may be entirely due to mechanical obstruction to the pumping action of the heart.

FITZGERALDISM—WHAT IS IT? (PRESSURE ANALGESIA). Wm. Harper DeFord, Des Moines, Ia. New Jersey State Dental Journal, September, 1914.

Impurities in Commercial Nitrous Oxid for Dental Use, and Their Injurious Effects by Inhalation. W. B. HART and F. W. MINHALL, *British Dental Journal,* June 15, 1914.

In their carefully tabulated analyses, Hart and Minhall have found that, considering the short interval of time that nitrous oxid is inhaled in dental anesthesia, and the large dilution of the gas by air or oxygen for analgesia the minute amounts of gaseous impurities found in the samples examined by them, are in general too small to have any effect on the patient, and it would appear that nitric oxid is the impurity that calls for special attention.

The purity of the gas can be maintained and the operation of purification simplified by the use of the purest ammonium nitrate as raw material. The use of ammonium sulfate or sodium nitrate calls for extraordinary precautions in manufacture, in view of the varying quality of these materials on the commercial market.

While Baskerville and Stevenson recommend a minimum of 95 per cent. of nitrous oxid in the commercial product, there appears to be no difficulties in the manufacture of a gas of 98 per cent., as the authors show in a table of American analyses.

Basing their conclusions on their analytical results, Hart and Minhall propose the following recommendations as to the quality of commercial nitrous oxid for anesthetic and analgesic use:

Nitrous oxid, 98 per cent. minimum; moisture, not to exceed 0.0002 gram per 100cc.; carbon dioxid, not to exceed 0.05 per cent. by volume; nitric oxid not to exceed 0.001 per cent. by volume; ammonia, not to exceed 0.001 per cent. by volume; hydrochloric acid, chlorin and its oxids, idodin, sulfur dioxid, sulfuric anhydrid, hydrogen sulfid, carbon monoxid, nitrogen, tri-, tetr-, and pentoxids, cyanogen, hydrocyanic acid, hydrogen phosphid, arsenid and antimonid, ozone, dust and all other impurities to be absent in an examination of 20 liters of the gas.

GENITO URINARY TRACT, GENERAL ANESTHESIA WITH SPECIAL REFERENCE TO THE SURGERY OF. J. T. Gwathmey. New York Medical Journal. November 7, 1914.

GENITO URINARY TRACT, LOCAL ANESTHESIA IN RELATION TO THE SURGERY OF. J. F. Mitchell, Washington, D. C. New York Medical Journal, November 7, 1914.

HIGH FREQUENCY ANALGESIA. Milton D. Neef. Dental Summary, November, 1914.

IMPURITIES IN NITROUS OXID. H. D. Haskins. Cleveland Medical Journal, August, 1914.

INTRA-ORAL OPERATIONS, ANESTHESIA FOR. F. H. McMechan. Cincinnati Medical News, August, 1914.

INTRAPHARYNGEAL ADMINISTRATION OF WARMED ETHER BY THE NASAL ROUTE. H. M. Page. Lancet, July 18, 1914.

INTRATRACHEAL INSUFFLATION. B. M. Ricketts, Cincinnati. Medical Record, September 19, 1914.

INTRATRACHEAL INSUFFLATION OF ETHER. H. T. Thompson, Edinburgh Medical Journal, August, 1914.

INTRAVENOUS ETHER ANESTHESIA. H. Kummell, Hamburg. Surgery, Gynecology and Obstetrics, September, 1914.

LOCAL ANESTHESIA. H. A. Brady, Danville, Va. Virginia Medical Semi-Monthly, September 11, 1914.

LOCAL ANESTHESIA. T. Torland, Seattle. Northwest Medicine, September, 1914.

LOCAL ANESTHESIA IN MAJOR SURGERY. W. A. Shelton, Kansas City. Missouri State Medical Association Journal, October, 1914.

LOCAL ANESTHESIA, OPERATIONS FOR INGUINAL HERNIA UNDER. J. A. Bodine, New York. Medical Record, September 26, 1914.

LOCAL ANESTHESIA IN RECTAL SURGERY. D. R. Pickens, Nashville. Tennessee State Medical Journal, September, 1914.

LOCAL ANESTHESIA, CONDUCTION AND INFILTRATION. B. R. East, Detroit. The Dental Summary, September, 1914.

LOCAL ANESTHESIA, THYROID OPERATIONS UNDER. F. H. Lahey. Boston Medical and Surgical Journal, October 8, 1914.

LOCAL ANESTHESIA, INTRAVENOUS. TOTAL PERIPHERAL ANALGESIA AFTER. A. W. Meyer. Archives für klinische Chirurgie, CV. No. 1.

Local Anesthesia in Over 1,000 Major Surgical Operations. J. A. CRISLER, Memphis, *Tennessee State Medical Journal,* July, 1914.

While Crisler has found nitrous oxid-oxygen anesthesia in conjunction with hyoscin-morphin, almost ideal in selected cases, he has found some patients who could not be thoroughly relaxed under it, and a few in whom surgical narcosis was impossible for a period sufficiently long for an average operation. Its objectionable features lie in the fact that an exceptionally experienced anesthetist is required for its administration and the necessary apparatus is only available in well-equipped hospitals.

Three years ago he began the use of hyoscin and morphin in connection with novocain to the exclusion of other anesthetics in operations for goitre, and he has gradually extended the use of these agents into abdominal surgery with gratifying results.

Three preliminary doses of morphin-hyoscin are given to secure amnesia and partial analgesia. The anoci-association technic of Crile is followed in obtunding the abdominal wall and the operative areas, and inhalation narcosis is only resorted to in about 25 per cent. of routine cases, in which the analgesia is not efficient on account of acute inflammatory conditions.

While the method lengthens the operative period, this objection is offset by the decrease in manipulative trauma, and peripheral shock. The technic also obviates anesthephobia, postoperative nausea, and diminishes the tendency toward flatulency, irritation of the kidneys and bronchial mucous membranes, and billiary necrosis.

The only complications noted in over 1,000 major operations were three cases of epileptiform convulsions, which occurred while operating in the neighborhood of the uterus and bladder. These seizures were brief and without any ill-effect. Artificial respiration has not been necessary in a single instance, although as much as a grain of morphin and 1/25 grain of hyoscin was used to secure narcosis. Coincidentally as much as two ounces of a 2 per cent. solution of novocain has been used without any toxic manifestations.

LOCAL ANESTHETICS, COMBINATION OF, WITH POTASSIUM SULPHATE. A. Hoffmann and M. Kochmann. Beiträge zur klisische Chirurgie, May, 1914.

LOCAL ANESTHETIC, QUININE AND UREA HYDROCHLORIDE AS A, IN EXPLORATORY OPERATIONS. E. D. Twyman, Independence, Mo. Missouri State Medical Association Journal, September, 1914.

LOCAL ANESTHETICS—SOME COMPARATIVE PHYSIOLOGICAL REACTIONS. O. E. Clossons, Detroit. Michigan State Medical Society Journal, October, 1914.

MAGNESIUM SALTS, ETHER AND CHLOROFORM. Editorial. Journal American Medical Association, August 15, 1914.

MORPHIN, LIMITATIONS AND USES OF, AS AN AID TO ANESTHESIA. J. S. Keyser, Wilmington. Delaware State Medical Journal, July, 1914.

NITROUS OXID-OXYGEN ANESTHESIA. H. L. Geary, Seattle. Northwest Medicine, September, 1914.

Nitrous Oxid, Some Considerations After 13,000 Administrations of. W. I. JONES, D.D.S., Columbus O., *Ohio State Medical Journal,* August, 1914.

Jones reports thirteen thousand administrations of nitrous oxide-oxygen with but one fatality on the table, in an extra-hazardous risk. While a large percentage of the anesthesias were for dental, quite a percentage were for major surgical operations in bad subjects. His youngest patient was four weeks, for cleft palate; his oldest 86 years, for prostatectomy.

His experience with nitrous oxid-oxygen in brain surgery corroborates Teter's, satisfactory anesthesia being maintained by 92 parts nitrous oxid and 8 parts oxygen. experiments during the operations proved conclusively that discoloration, dilitation and protrusion of the brain occurred only in the presence of oxygen deprivation, and assumed dangerous proportions only when asphyxia was imminent. Jones has met with occasional instances of acapnia in anemic and asphyxia in plethoric, obese or alcoholic subjects; but all cases responded promptly to artificial respiration and perflation with oxygen.

McKesson's findings regarding blood pressure during 4,000 nitrous oxid-oxygen anesthesia are also corroborated in Jones' experience, and he has observed that any imperiling turgesence of blood vessels, even in the presence of arterio-sclerosis must be the result of either asphyxia or pushing the anesthesia beyond the depth required for surgical interference.

For safe and satisfactory results with this technic of anesthesia Jones suggests that the anesthetist should bring as much skill to its administration as the surgeon does to the operation. He offers his records and the desperate character of many of the cases handled to contravert the efforts of some surgeons to indescriminately condemn the technic.

Ether in small amounts for purposes of relaxation was necessitated in from 20 to 25 per cent. of the cases recorded.

Jones concludes that while nitrous oxid-oxygen anesthesia does not make the work of the surgeon easier, it is immeasurably better for the patient.

NOVOCAIN POISONING. R. P. Giffen and F. F. Gundrum, Santa Barbara. California State Journal, October, 1914.

OIL-ETHER COLONIC ANESTHESIA. J. T. Gwathmey, New York. Medical Record, October 3, 1914.

OIL-ETHER COLONIC ANESTHESIA. W. W. Spargo, Albuquerque. New Mexico Medical Journal, July, 1914.

PARAVERTEBRAL ANESTHESIA FOR GALL BLADDER SURGERY. A. T. Jurasz. Zentralblatt für Chirurgie, August 29, 1914.

Posture in Relation to General Anesthesia. MACCARDIE, Birmingham, *Proceedings of the Royal Society of Medicine, Section of Anesthetics,* April, 1914.

While the Trendelenburg posture may be advantageous to the surgeon during certain phases of operative procedures, it may give rise to complications that jeopardize the life of the patient or that make the maintenance of general narcosis extremely hazardous. It is McCardie's opinion that frequently anesthetics have been blamed for these complications which are really induced by this particular posture, especially when the angle of inclination has exceeded 45 degrees. The posture not only promotes copious venous hemorrhage, and embarrasses pulmonary ventilation, but also puts an additional strain on the heart. Likewise it seems to be an important factor in the occurrence of post-operative pneumonia and bronchitis; and Zweifel holds it occasionally responsible for post-operative intestinal obstruction, surgical emphesema, apoplexy and acute dilitation of the stomach. Zweifel reduced the incidence of pulmonary embolism from 18 cases in 1,800 operations to 3 in 800, by resorting to the posture as infrequently as possible, and then maintaining the extremities in the same horizontal plane as the body instead of allowing them to be flexed over the end of the table.

The recent researches of Meltzer, Auer and Githens on the curare-like action of ether in promoting the fatigability of musculature, explains why the Trendelenburg posture is more dangerous during ether narcosis than when chloroform is used; or when, according to Gatch, Gann and Mann, the patient is properly under the influence of morphine. These observers conclude that the ill-effects of the Trendelenburg posture are due primarily to failure of respiration, and can only be combated by the stimulation of hypercapnia. In the presence of even mild grades of asphyxial embarrassment, the entire mechanism with which the body compensates for the effects of gravity, is put to an exhaustive strain, and the heart has to pump against an increased arterial pressure at a time when it is poorly able to respond.

McCardie concludes by advising that the posture be resorted to as infrequently as possible; and then only for brief periods, and that it should not be used at all on patients suffering from obesity, obstructed breathing, cardiac, renal or arterial complications. Also the posture should be sustained by support at the shoulders, and not by allowing the legs to hang over the edge of the table, in order to obviate the danger of thrombosis.

Gatch has even found it advisable to operate some hazardous risks, under gas-oxygen anesthesia in a semi-sitting position or the reverse Trendelenburg.

PROSTATECTOMY UNDER LOCAL ANESTHESIA. Emory Lanphear, St. Louis. The Urologic and Cutaneous Review, November, 1914.

PSYCHIC FACTORS OF SURGICAL ANESTHESIA. R. H. Ferguson, East Orange, N. J. Illinois State Medical Journal, August, 1914.

RECORD CARD FOR THE ANESTHETIST. P. L. Flagg, New York. Journal American Medical Association, September 19, 1914.

REGIONAL ANALGESIA FOR ABDOMINAL OPERATIONS H. Hackenbruch. Deutsche Zeitschrift für Chirurgie, CXXVIII, Nos. 5-6.

SCOPOLAMIN-MORPHIN, USE OF, IN LABOR. A. Rongy and S. S. Arluck. New York Medical Journal, September 19, 1914.

SCOPOLAMIN-MORPHIN IN LABOR. Magnus Tate, Cincinnati. Lancet-Clinic, October 24, 1914.

SCOPOLAMIN-NARCOPHIN SEMINARCOSIS IN LABOR. A. Harrar and R. McPherson, New York. American Journal of Obstetrics, October, 1914.

SHOCK, TREATMENT OF, CONSERVATION VERSUS STIMULATION IN. C. S. Holt, Fort Worth. Arkansas Medical Society Journal, September, 1914.

SHOCK, PSYCHIC, FOLLOWING OPERATIONS. J. E. Engstad, Minneapolis. Journal-Lancet, October 1, 1914.

SHOCK, TRAUMATIC. S. W. Hobson, Newport News. Virginia Medical Semi-Monthly, October 9, 1914.

Shock, Peripheral Origin of. F. C. MANN, Indianapolis, *Bulletin of Johns Hopkins Hospital,* July, 1914.

While Mann found it possible to produce the usual signs of shock in animals by means of excessive heat or cold, the condition supervened far more readily by exposure and trauma of the abdominal viscera. With the abdominal wall intact and hemorrhage prevented, Mann found it impossible to reduce anesthetized animals to a state of shock by any degree of sensory stimulation. While the respiratory center is more quickly injured by shock than any other vital center, acapnia is not a primary factor in its incidence. The vasomotor is the most resistant of all vital centers and is not depressed nor fatigued in shock. That shock is due to primary failure of the heart, due to involvement of the cardio-inhibitory or cardio-accelerator mechanism, cannot be maintained, since the peripheral and untraumatized visceral arteries are constricted in its presence.

While shock produced by exposure and trauma of the abdominal viscera may be partly due to a paralysis of the vasamotor mechanism of the splanchnic area, still Mann considers that the more important factor is the tremendous loss of red cells and fluid from the blood, due to the reaction of the great, delicate vascular splanchnic area to irritation—an acute inflammation of the peritoneum due to operative trauma and exposure to changes of temperature. The peritoneum offers an area of exposure equal to the entire cutaneous surface of the body, and the supervention of shock, similar to the abdominal type, only occurs when a great area of subcutaneous tissue has been exposed and traumatized.

Muscular relaxation, decreased abdominal pressure, and impaired respiration are accessory factors, because they tend to decrease the amount of blood returned to the heart. A relatively slight decrease in blood-supply markedly depresses the cellular activity of the cerebral cortex, and degenerative changes in the cells of the central nervous system are the result and not the cause of shock. General anesthesia, just short of the loss of muscle tone, prevents painful impulses from affecting the cells of the central nervous system. Under such conditions, Mann considers nerve blocking as useless in the prevention of shock.

According to Mann, the term "shock" should only be used to apply to the patient's condition when, without any grossly discernable hemorrhage having occurred, the amount of circulatory fluid is greatly diminished on account of stagnation of the blood in the smaller veins and capillaries or by exudation of the fluid and cellular elements of the blood from the same.

SPINAL ANESTHESIA. J. Overton and L. E. Burch, Nashville, Tenn. The Southern Practitioner, October, 1914.

SPINAL ANESTHESIA. C. G. Parsons. Denver Medical Times, November, 1914.

SPINA ANESTHESIA, EXPERIENCES WITH. A. Gfoerer. Muenchener medicinische Wochenschrift, September 8, 1914.

SPINAL ANESTHESIA IN UROLOGY. G. G. Smith, Boston. Inter-State Medical Journal, November, 1914.

TRIGEMINAL NEURALGIA, TREATMENT OF, BY INTRACRANIAL INJECTIONS OF ALCOHOL. Hartel. Deutsche Zeitschrift für Chirurgie, Band 126, Heft 5-6, 1914.

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